Technical Memorandum TRAC-TM-0193
January 1993

Light Cavalry Regiment Evaluation

TRADOC Analysis Command
Operations Analysis Center
Combined Arms Analysis Directorate
Fort Leavenworth, Kansas 66027-5200

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LIGHT CAVALRY REGIMENT (LCR)
EVALUATION
FINAL REPORT

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	January 1993	Final Report Nov 91-Jan 93

4. TITLE AND SUBTITLE
Light Cavalry Regiment (LCR) Evaluation

5. FUNDING NUMBERS

6. AUTHOR(S)
Ms. Iris Prueitt, Ms. Helen Lee, Mr. Robert Washer, and Mr. Bruce Lasswell

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
TRADOC Analysis Command-Operations Analysis Center
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ATTN: ATRC-FC
Fort Leavenworth, KS 66027

8. PERFORMING ORGANIZATION REPORT NUMBER
TRAC-TM-0193

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Combined Arms Command-Combat Developments
Force Design Directorate
ATTN: ATZL-CDF
Fort Leavenworth, KS 66027

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The Light Cavalry Regiment (LCR) evaluation was a study conducted by the Combined Arms Analysis Directorate of the TRADOC Analysis Command. This document is the final report for the LCR evaluation.

The LCR evaluation was a follow-on to the Air Ground Motorized Cavalry (AGMC) evaluation. AGMC was an investigation into the appropriate force structure and equipment for a 2004 LCR. Upon receiving the results of AGMC, the Commander of the Combined Arms Command requested a study to evaluate the LCR equipped with current day (1992) equipment. The evaluation provided analytic insights on combinations of HMMWVs, M113s, M3s, and LAV25s in various roles within the light cavalry.

14. SUBJECT TERMS
Light cavalry regiment, ground cavalry squadron, deep reconnaissance squadron

15. NUMBER OF PAGES
56

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNLIMITED

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APPLICABILITY

This analytic effort supported the pending re-equipping of the 199th MIB to become the Light Cavalry Regiment (LCR). Timing was critical as the decision was imminent. The analysis was streamlined by limiting the alternatives considered, the areas of analysis, and the combat scenarios developed for simulations. Even with this limited approach, the study sponsor concurred with the study plan and supported the effort. The study sponsor felt that results, while limited, would provide some quantitative insight into an otherwise qualitative decision. The end product of this analysis was used to supplement sound military judgement as the Force Design Directorate of the Combined Arms Command made a proposal to DCSOPS for re-equipping the unit. In the end, with funds limited, the 199th MIB became the LCR with existing equipment. Plans were made to upgrade the equipment as new systems, appropriate for the cavalry mission, come into the force.

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GLOSSARY

ATACMS Blk I	Army tactical missile block I
AALPS	Automated Air Load Planning System
AGMC	Air/ground motorized cavalry
ALB	AirLand Battle
AMMH	annual maintenance manhours
AVIM	aviation intermediate maintenance
AVUM	aviation unit maintenance
CAA	Concepts Analysis Agency
CAC	Combined Arms Command
CAC-CD	Combined Arms Command-Combat Developments
CAS	close air support
CASCOM	Combined Arms Support Command
CS	combat support
CSS	combat service support
DS	direct support
EEA	essential element of analysis
EUR	Europe
FASCAM	family of scatterable mines
FASTALS	Force Analysis Simulation of Theater Administrative and Logistics Support (model)
FDD	Force Design Directorate
FER	force exchange ratio
FLIR	forward-looking infrared
GS	general support
HMMWV	high-mobility multipurpose wheeled vehicle
HRS	high-resolution scenario
ICM	improved conventional munitions
km	kilometer
LATAM	Latin America
LAV	light armored vehicle
LAV25	light armored vehicle equipped with 25mm gun
LCR	light cavalry regiment
LIA	logistics impact analysis
LIN	line item number
MAC	Military Airlift Command
MARC	manpower authorization requirements criteria
MLRS	multiple-launch rocket system

GLOSSARY

MOE	measure of effectiveness
MOS	military occupational specialty
METT-T	mission, enemy, terrain, troops, and time available
NATO	North Atlantic Treaty Organization
SER	system exchange ratio
SME	subject-matter expert
SRC	standard requirement code
STON	short ton
SWA	southwest Asia
SWC	Scenario and Wargaming Center
TAA	total Army analysis
TOE	table of organization and equipment
TOW	tube-launched, optically tracked, wire guided
TRAC	TRADOC Analysis Command
TRAC-SWC	TRAC-Scenario and Wargaming Center
TRADOC	Training and Doctrine Command
WSMR	White Sands Missile Range

LIGHT CAVALRY REGIMENT EVALUATION

SUMMARY

1. Purpose. To evaluate the different light cavalry regiment (LCR) designs for strengths and weaknesses using the parameters and missions stated in the November 1991 Combined Arms Command-Combat Developments (CAC-CD) memorandum. The memorandum is included at appendix A.

2. Introduction.

a. On 9 October 1991, a briefing was given to the CAC Commander regarding the status of the design of an LCR. This briefing was the culmination of the Air Ground Motorized Cavalry (AGMC) study. The focus of this study included the comparison of three futuristic light cavalry designs. The briefing given to the CAC Commander centered on a compromise design combining the strengths of each of these futuristic alternatives.

b. The response from the CAC Commander turned the focus of the force designers. The Commander directed that an LCR be designed based on current equipment. He stated that the high-risk nature of the futuristic systems drove a need for a more realistic review of currently available capability. This requirement, an LCR of currently fielded equipment, became the basis for the LCR evaluation.

c. In a November 1991 memorandum, the CAC-CD Force Design Directorate (FDD) tasked the Training and Doctrine Command (TRADOC) Analysis Command (TRAC) to provide analytic support for the LCR evaluation. The memorandum included the following requirements for analytic support:

(1) Evaluate lethality, deployability, and survivability of each alternative.

(2) Conduct a logistics impact analysis (LIA) which provides as a minimum, insights into classes III, V, VII, and IX requirements of the alternatives.

(3) Assess the effectiveness of the reconnaissance squadron with current equipment.

d. CAC-CD's November 1991 memorandum also stated the following priorities for the scenarios to be used in the evaluation.

(1) Southwest Asia (SWA).

(2) Latin America (LATAM).

(3) Europe (EUR).

3. Discussion.

a. *Methodology.*

(1) The study methodology was included in the Analytical Support Plan for the LCR evaluation. This document methodically establishes the appropriate essential elements of analysis (EEA) and the corresponding measures of effectiveness (MOE) for each quantifiable parameter.

(2) The study team charged with evaluating these parameters included TRAC elements from Fort Leavenworth, KS; Fort Lee, VA; and White Sands Missile Range (TRAC-WSMR), NM.

(3) The major analytic tools used in this study were computer models. Mission analysis of lethality and survivability was conducted using Janus, a high-resolution force-on-force computer simulation. Deep reconnaissance effectiveness was evaluated using Eagle, a low-resolution division model. Deployability assessment was accomplished with the aid of the Automated Air Load Planning System (AALPS), a logistical model for determining sortie requirements. Logistics implications were measured via the Force Analysis Simulation of Theater Administrative and Logistics Support (FASTALS), a theater-level model that calculates support requirements.

(4) The high-resolution mission analysis focused on a SWA screening mission. This scenario was developed from SWA 3.0 (using updated SWA 4.0 tables of organization and equipment (TOE)) and was created specifically in support of AGMC. This high-resolution snapshot covered a 50-kilometer (km) frontage. This scenario, AGMC 2.0, was previously certified by TRAC-Scenario and Wargaming Center (SWC) for AGMC as an appropriate light cavalry mission. TRAC-WSMR conducted the Janus gaming and subsequent analysis. The lack of additional scenarios, appropriate for light cavalry missions, limited the ability to analyze the flexibility of the alternatives. By using one scenario, the alternatives were tested against one terrain and one threat. The open terrain of SWA allows some systems to excel while possibly handicapping others. Analysis over various terrains and threats may have exposed strengths and weaknesses across the alternatives, and the conclusions would better face the test of world-wide contingency usage. This does not invalidate the work since SWA is a potential contingency operation. It merely reinforces required consideration of METT-T when task organizing a force.

(5) The Eagle model was employed to measure the effectiveness of the deep recon squadron. First, an off-line analysis was conducted to evaluate the survivability of a deep reconnaissance mission with current equipment. Second, the Eagle model was used to evaluate this unit's capability to find targets and call deep fires.

(6) The AALPS model was used to determine aircraft sortie requirements for the deployment of each of the force designs. The aircraft under consideration were the C-5 and C-141.

(7) The LIA was a comparative analysis of the logistic requirements of each force design.

(a) Supply requirements were calculated for all classes with emphasis on classes III, V, VII, and IX. This analysis was prepared using spreadsheet analysis based on supply planning factors.

(b) Maintenance requirements were calculated using a spreadsheet analysis based on the annual maintenance manhour (AMMH) requirements by line item number (LIN) for the equipment in each alternative. Using productivity factors, these were then converted into mechanic manpower requirements.

(c) The alternatives were so similar in design that some portions of the traditional LIA were not warranted in this analysis. Transportation requirements and combat service support (CSS) force structure requirements were assessed to be non-discriminators for the six alternatives evaluated in the LIA process, and therefore, these requirements were not analyzed.

b. *Alternatives.*

(1) In the original tasking, CAC-CD FDD proposed six alternatives. At a later date, two additional alternatives were added. The timing of the two additional alternatives prevented them from being included in all areas of analysis. Table 1 depicts the areas of analysis addressed for each alternative. An "X" denotes that analysis was conducted, a "-" denotes that analysis was not done.

Table 1. Areas of analysis

Alternative	Mission Analysis	AALPS	LIA	Deep Recon
1	X	X	X	X
2	X	X	X	-
3	X	X	X	-
4	X	X	X	-
5	X	X	X	-
6	X	X	X	-
7	X	X	-	X
8	-	X	-	-

(2) Seven of the eight alternatives considered in the LCR were based on variations in the platforms/weapons of one common regimental design. The design is shown in figure 1. The

variations in platforms/weapons exist in the ground cavalry squadron. All other equipment and units of the regiment remain constant. Alternative 8 was a variation on the regimental design. This design is shown in figure 2.

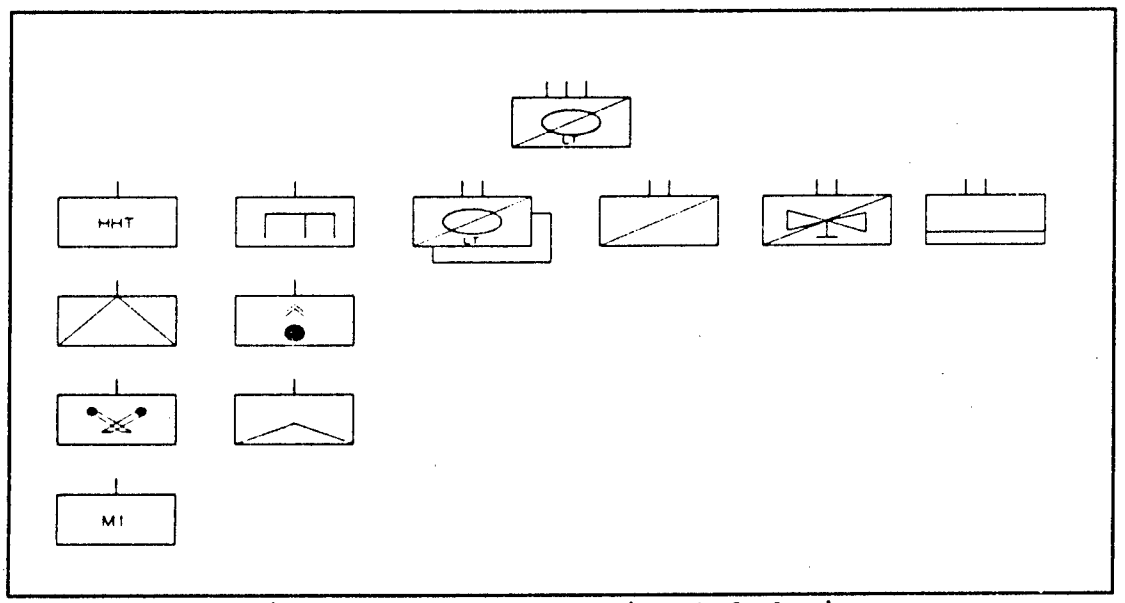


Figure 1. Common regimental design

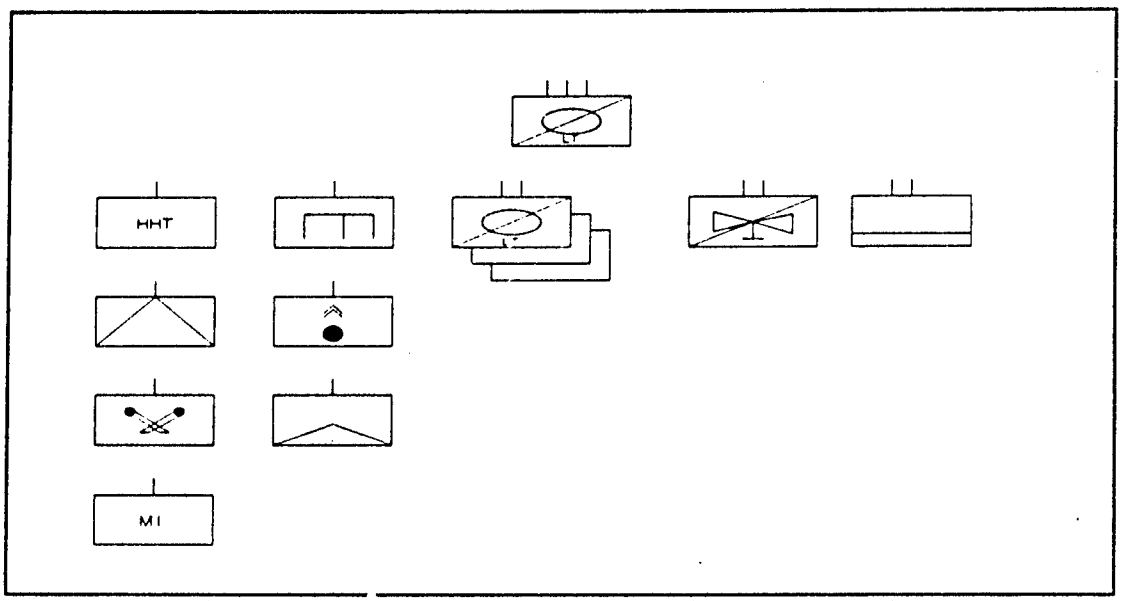


Figure 2. Alternative 8 regimental design

(3) The alternatives are formed by varying the platform/weapon for three "roles" within the squadron. These three roles are: the close reconnaissance vehicle, the cavalry vehicle, and the light armor vehicle. The first two are in the light cavalry troop, and the third is in the light armor troop. Table 2 briefly describes each alternative.

Table 2. Alternatives

Alternative	Close Recon	Cavalry	Lt Armor
1	M113	HMMWV-TOW	HMMWV-TOW
2	HMMWV	HMMWV-TOW	HMMWV-TOW
3	M113	M3	HMMWV-TOW
4	M113	HMMWV-TOW	M3
5	HMMWV	HMMWV-TOW	M3
6	M113	M3	M3
7	LAV25	M113-TOW	M113-TOW
8 *	M113	HMMWV-TOW	HMMWV-TOW

* Alternative 8 uses the same equipment as alternative 1 in a different regimental design.

c. *Findings.*

(1) Mission analysis.

(a) The high-resolution Janus gaming was utilized to analyze seven of the eight alternatives. The scenario gamed was a SWA screening mission in which each alternative force was required to strip the threat recon, shadow main body movement, and complete preplanned Blue maneuver. The first six alternatives presented similar results and will be discussed together. Alternative 7, while similar in regimental structure, varied in systems and results. This alternative will be discussed separately.

(b) The first six alternatives were tactically deployed and fought in the same manner. The close recon vehicles were either the high-mobility multipurpose wheeled vehicle (HMMWV) or the M113 equipped with a 50/50 mix of MK19 and .50 cal weapons. The contributions of these systems were limited based on the capability of the weapon systems. For this scenario and terrain, these recon vehicles provided equal early warning and no contribution to the fight. For the most part, they served as targets. The overwatch vehicles and the light armor vehicles in these first six alternatives were either HMMWV-TOW or M3. Both vehicles use the TOW missile as their primary weapon. The differences in these vehicles are in the basic load (six missiles for the HMMWV and 12 for the M3), survivability, and acquisition capability. The basic load gave advantage to the M3 by being

able to sustain the fight longer. The acquisition advantage belonged to the M3 because of the higher platform. The survivability of the M3, as compared to the HMMWV, was the major discriminator. Most measurable factors reflect improved performance correlated to the quantity of M3s in the design. For the first six alternatives, alternative 6 performed best.

(c) Alternative 7 is equipped with substantially different equipment. The close recon vehicle of alternative 7 is the light armored vehicle (LAV) equipped with a 25mm gun (LAV25). This vehicle is equally capable in acquisition to the previous close recon vehicles but exceeds their performance by becoming an active participant in the fight. The 25mm gun gives this system the range and firepower to make a difference in the fight. This vehicle accounts for approximately 11 percent of the kills while the close recon vehicle of the first six alternatives only served as an early warning system. The LAV25 could have successfully remained in position longer, destroyed more targets, and survived but, to discern equipment differences, the tactics were kept constant across alternatives by withdrawing the close recon vehicle after initial contact with threat recon. This prevented multiple effects from varying equipment and tactics simultaneously. The M113-TOW has the same missile capability as the HMMWV-TOW and the M3. The performance of the M113-TOW is comparable to that of the M3 in the other alternatives. This system is lethal and inherently more survivable than the HMMWV. Its survivability is enhanced by the fact that the LAV25 is playing an active role in the fight which reduced the needed contribution of the M113-TOW.

(2) Recon squadron effectiveness.

(a) Off-line analysis of the vulnerability of HMMWVs and LAV25s in the role of a deep reconnaissance squadron, prove these systems inappropriate for this mission. The probability of being detected by threat reconnaissance vehicles is so great that it would be impossible, in this scenario, to adequately cover the required frontage and avoid having a large percentage of the recon vehicles seen by threat reconnaissance.

(b) For analytic purposes, the HMMWVs and LAV25s were considered 100-percent survivable for Eagle to assess the potential of a deep reconnaissance squadron to call fires if the survivability issue could be solved. The results show that the unit can adequately cover the required frontage and can provide information for the placement of deep fires. However, the unit was still found to be ineffective in its synergistic role with deep fires. The limiting factor is the requirement to use only current equipment. Army tactical missile system block I (ATACMS Blk I) does not allow sufficient damage to be done to the threat formations in this scenario. Based on these two factors, vulnerability of the HMMWV and ineffectiveness of Blk I, the effectiveness of the deep reconnaissance squadron was judged as limited.

(3) The LIA was conducted on the first six alternatives. The similarities of these alternatives carried through to logistics requirements. The study sponsor was not able to quantify any logistic constraints against which to measure. Based on the lack of an established constraint and very similar logistic requirements, it becomes impossible to determine which is the preferred alternative from this perspective alone. The areas in which differences were determined correlated to the density of heavy equipment. For example, the alternative which required the most annual maintenance manhours (AMMH), general support (GS) mechanics, and classes III, V, and VII is alternative 6. This is correlated to the quantity of tracked vehicles in this alternative. Correspondingly, alternative 2 has the least requirements based on a force structure depending solely on HMMWVs.

(4) Deployment was analyzed as air deployment only. The aircraft utilized in this analysis were C-141s and C-5s. The C-5s were only utilized for oversized equipment. Again, the density of heavy and oversized equipment drove the deployability analysis. Alternative 6, consisting of all tracked vehicles, required the greatest number of sorties, and alternative 2, consisting of all wheeled vehicles, required the least number of sorties.

4. Conclusions.

a. LIA. The comparison among the alternatives shows very little difference in the area of logistics. Similarity in organizational structure and personnel requirements caused most of the logistic requirements to be similar. Differences correlated to the quantity of tracked vehicles versus wheeled vehicles.

b. Deployment. Although the number of sorties required for deployment of each alternative are different, without a predetermined standard or requirement there is no way to truly determine a level of sortie requirement that is either unacceptable or favorable. Without this information, which the study sponsor is not able to state categorically, this area is merely presented for relative comparison.

c. Mission analysis.

(1) The mission analysis did discern some differences which are valuable. Among the first six alternatives, it becomes obvious that the comparison of the M3 versus the HMMWV, in the roles of cavalry vehicle or light armor vehicle, favors the M3. Again, this is directly correlated to the larger weapons load, better survivability against artillery attack, and longer range acquisition capability of the M3. The comparison among the first six alternatives of the close recon vehicle shows no real difference between the M113 and the HMMWV. This result is directly correlated to the similar weapon capability of the

MK19/.50-cal which is associated with both chassis. In the mission analyzed, these close recon vehicles were of very little use. They were merely targets.

(2) Alternative 7 demonstrates results somewhat different from the first six alternatives. In alternative 7, the LAV25 served as the close recon vehicle capable of taking an active role in the fight. This vehicle was able to detect as early as the close recon vehicles of the first six alternatives but, in addition, it was able to attrit approximately 11 percent of the force. This active role of the LAV25 certainly provides insight into equipping the close recon vehicle with a weapon system that has contributing range and firepower. In becoming an active participant in the fight, the LAV25 took targets away from the air and ground assets. This allowed the ground systems to survive better based on a decreased mission requirement. We see a slight decrease in OH-58D survivability which is attributed to the fact that the LAV25 was stripping away the forward, thin-skinned recon vehicles which had previously belonged to the air assets. Now the OH-58Ds stayed in position longer waiting for the LAV25 to turn over the battle, and they faced more capable threat systems. The decrease in survivability is marginal.

d. Recon squadron effectiveness. The Eagle analysis proved the ineffectiveness of the deep reconnaissance squadron built with current equipment. Off-line analysis proved the HMMWV/LAV25-based recon squadron to be of questionable survivability. The requirement for sufficient density in order to adequately cover the terrain and the silhouette of the HMMWV/LAV25 proved it to be an inappropriate deep recon vehicle for this mission and terrain. Accepting the probable limited survivability of the HMMWV/LAV25, while allowing it to be completely survivable for analytic purposes, still proved this unit to be ineffective in its mission. The ability of this unit to call destructive fires is a function of its inherent capability in union with the capability of the deep fires. Restricted to current systems, which would only include ATACMS Blk I, this unit proved ineffective in destroying significant numbers of threat vehicles with the lethality of ATACMS Blk I.

5. Recommendations.

a. The conclusions of the mission analysis support the inclusion of a close recon vehicle equipped with a weapon of contributing range and an M3 in the role of cavalry and light armor vehicle. This is strictly from a mission analysis point of view and does not consider the other areas of analysis.

b. The deployability analysis offers insight into an area which may become extremely prohibitive. The availability of aircraft may be deemed a factor equal in weight to the mission analysis during times of high demand on resources. In this case, the performance increase of the M3 over the M113-TOW and the HMMWV-TOW may not warrant the additional sorties required to air

deploy the M3. The M3 requires at least one C-141 to air deploy. Deployment configurations used by current units call for six C-141s for every four M3s. This demand on available aircraft makes the M3 alternatives less desirable. As the deployment analysis was ongoing, the certification for the M3 to be air deployed on a C-141 was pulled because of substantiated damage to both the aircraft and the M3 during the loading process. With this information, a more appropriate overwatch vehicle and light armor vehicle may be the more readily deployable M113 or the HMMWV which offers only slightly reduced capability in comparison with the M3.

c. The Eagle analysis substantiates the elimination of the deep reconnaissance squadron from the regiment. The highly vulnerable HMMWV/LAV25 and the marginally effective deep fires do not warrant the inclusion of this unit. No analysis was done to determine an appropriate replacement. Since the ground cavalry squadron and the regimental aviation squadron both contribute significantly, in terms of mission capability, perhaps the spaces could be better utilized by inclusion of an additional squadron of either of these assets.

LIGHT CAVALRY REGIMENT EVALUATION

CHAPTER 1

INTRODUCTION

1-1. Purpose. To evaluate the different LCR designs for strengths and weaknesses using the parameters and missions stated in the November 1991 CAC-CD memorandum.

1-2. Problem statement.

a. On 9 October 1991, a briefing was given to the CAC Commander regarding the status of the design of an LCR. This briefing was the culmination of the AGMC study. The focus of this study included the comparison of three futuristic light cavalry designs. The briefing given to the CAC Commander centered on a compromise design combining the strengths of each of these futuristic alternatives.

b. The response from the CAC Commander turned the focus of the force designers. The Commander directed that an LCR be designed based on current equipment. He stated that the high risk nature of the futuristic systems drove a need for a more realistic review of currently available capability. This requirement, an LCR of currently fielded equipment, became the basis for the LCR evaluation.

c. In a November 1991 memorandum (appendix A), CAC-CD FDD tasked TRAC to provide analytic support for the LCR evaluation. The memorandum included the following requirements for analytic support:

(1) Evaluate lethality, deployability, and survivability of each alternative.

(2) Conduct a LIA which provides as a minimum, insights into classes III, V, VII, and IX requirements of the alternatives.

(3) Assess the effectiveness of the reconnaissance squadron with current equipment.

d. CAC-CD's November 1991 memorandum also stated the following priorities for the scenarios to be used in the evaluation.

(1) SWA.

(2) LATAM.

(3) EUR.

1-3. Related efforts.

a. The AGMC study preceded the LCR evaluation. The focus of AGMC was to determine the appropriate organizational design for the LCR based on future equipment and capabilities. The analysis highlighted strengths which were to be incorporated into the design and identified weaknesses in structure to avoid. The culmination of this effort was a proposed, futuristic LCR design.

b. Using this work, the CAC Commander directed the force designers to replace the future equipment and capabilities with those currently in the force. His intent was to evaluate the recommended force design with capabilities known to exist and readily analyzable. The high risk nature of future equipment may prevent it from becoming a reality while currently fielded equipment could be made available to a unit immediately. This requirement preceded the LCR evaluation.

1-4. Assumptions.

a. System definitions were available in sufficient detail for evaluation purposes.

b. Threat doctrine, equipment, and force structure projections through 1996 were accurate.

c. Blue doctrine and equipment projections through 1996 were accurate.

d. Approved surrogate data was available to be substituted for identified data deficiencies.

e. The warfight represented in the Concepts Analysis Agency (CAA) Desert Shield SWA attack scenario was appropriate for the purposes of the LIA.

f. The basic structure and support relationships established for corps units remained the same for all the alternatives.

g. Standard requirement code (SRC) TOEs developed for AirLand Battle (ALB) were appropriate for use.

h. Supply requirements based on Army planning factors were representative of supply requirements.

i. Maintenance requirements based on Army manpower authorization requirements criteria (MARC) maintenance data base information were representative of maintenance requirements.

1-5. Scope.

a. *Limitations.*

(1) Only six alternatives were originally proposed for analysis. At a later date, CAC-CD FDD added two additional designs. Because of the timing of the additions, not all areas of analysis were conducted for all alternatives.

(2) The analysis addressed only those issues identified in the request for support (appendix A).

b. *Constraints.*

(1) The request for support for this evaluation stated that the priorities for the scenarios were SWA and LATAM. The availability of only one high-resolution scenario (HRS) conducive to evaluating light cavalry operations was a constraint of this evaluation. The lack of additional scenarios, appropriate for light cavalry missions, limited the ability to analyze the flexibility of the alternatives. By using one scenario, the alternatives were tested against one terrain and one threat. The open terrain of SWA allows some systems to excel while possibly handicapping others. Analysis over various terrains and threats may have exposed strengths and weaknesses across the alternatives, and the conclusions would better face the test of world-wide contingency usage. This does not invalidate the work since SWA is a potential contingency operation. It merely reinforces required consideration of METT-T when task organizing a force.

(2) The study used the previously certified AGMC 2.0 SWA scenario for evaluating the cavalry missions. Due to time constraints of the study, the study team did not develop a LATAM scenario.

(3) The LIA was constrained in scope and depth by time. The time constraint relates to the fact that the design of the support squadron took more time than was originally allotted and this directly impacted the work on the LIA. In addition, the two final alternatives were not evaluated for logistics because of time constraints.

(4) Due to the level of resolution of current data defining these units, manpower requirements were determined only in terms of enlisted personnel.

LIGHT CAVALRY REGIMENT EVALUATION

CHAPTER 2

STUDY METHODOLOGY

2-1. Overview.

a. The study methodology was included in the analytical support plan for the LCR evaluation. This document methodically established, for each quantifiable parameter, the appropriate EEA and the corresponding MOE.

b. The study team charged with evaluating these parameters included TRAC elements from Fort Leavenworth, Fort Lee, and WSMR.

c. The major analytic tools used in this study were computer models. Mission analysis was conducted using Janus, a high-resolution force-on-force computer simulation. Deep reconnaissance effectiveness was evaluated using Eagle, a low-resolution division model. Deployability assessment was accomplished with the aid of AALPS, a logistics model for determination of sortie requirements. Logistics implications were measured by spreadsheet analysis.

d. The high-resolution mission analysis focused on a SWA screening mission. This scenario was developed from SWA 3.0 (using SWA 4.0 TOE) and was created specifically in support of AGMC. This high-resolution snapshot covered a 50km frontage. This scenario, AGMC 2.0, was previously certified by TRAC-SWC for AGMC as an appropriate light cavalry mission. TRAC-WSMR conducted the Janus gaming and subsequent analysis.

e. The Eagle model was employed to measure the effectiveness of the deep recon squadron. First, an off-line analysis was conducted to evaluate the survivability of a deep reconnaissance mission with current equipment. Second, the Eagle model was used to evaluate this unit's capability to find targets and call deep fires.

f. The AALPS model was used to determine aircraft sortie requirements for the deployment of each of the force designs. The aircraft under consideration were the C-5 and C-141.

g. LIA. The LIA was a comparative analysis of the logistic requirements of each force design.

(1) Supply requirements were calculated for all classes with emphasis on classes III, V, VII, and IX. This analysis was prepared using spreadsheet analysis based on supply planning factors.

(2) Maintenance requirements were calculated using a spreadsheet analysis based on the AMMH requirements by LIN for the equipment in each alternative. Using productivity factors, these were then converted into mechanic manpower requirements.

(3) The alternatives were so similar in design that some portions of the traditional LIA were not warranted in this analysis. Transportation requirements and CSS force structure requirements were assessed to be nondiscriminating for the six alternatives evaluated in the LIA process.

2-2. Alternatives.

a. In the original tasking, CAC-CD FDD proposed six alternatives. At a later date, two additional alternatives were added. The timing of these additions prevented them from being included in all areas of analysis. Table 2-1 depicts the areas of analysis addressed for each alternative. An "X" denotes that analysis was conducted, and a "-" denotes that analysis was not done.

Table 2-1. Areas of analysis, each alternative

Alternative	Mission Analysis	AALPS	LIA	Deep Recon
1	X	X	X	X
2	X	X	X	-
3	X	X	X	-
4	X	X	X	-
5	X	X	X	-
6	X	X	X	-
7	X	X	-	X
8	-	X	-	-

b. Seven of the eight alternatives considered in the LCR evaluation were based on variations in the platforms/weapons of one common regimental design. This design is shown in figure 2-1. The variations in platforms/weapons exist in the ground cavalry squadron. All other equipment and units of the regiment remain constant. Alternative 8 was a variation on the regimental design and included three ground cavalry squadrons with no deep recon squadron. This design is shown in figure 2-2.

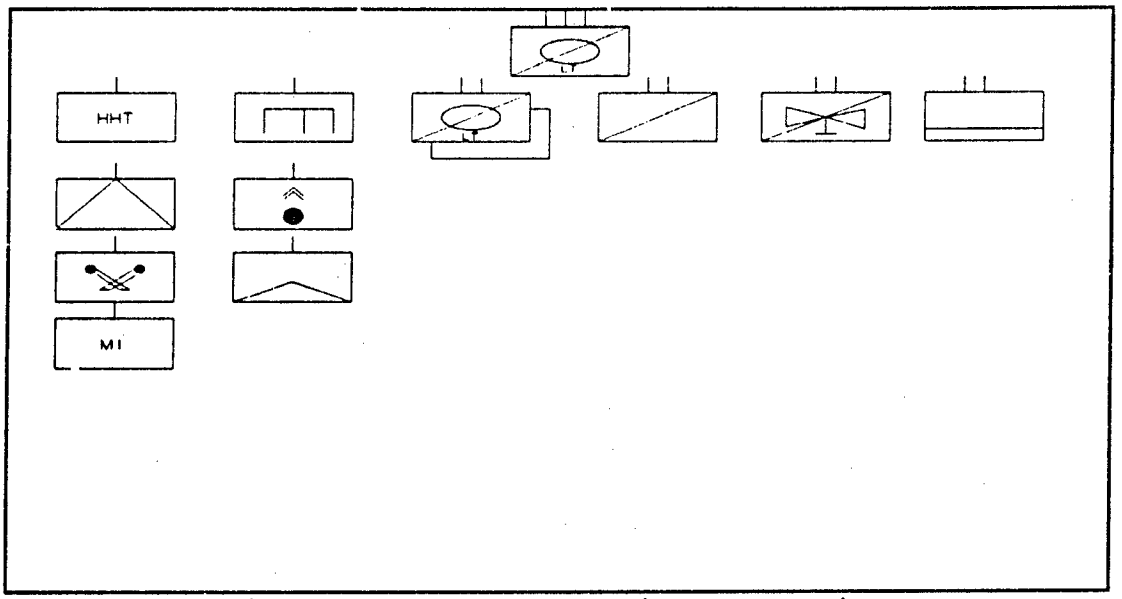


Figure 2-1. Common regimental design

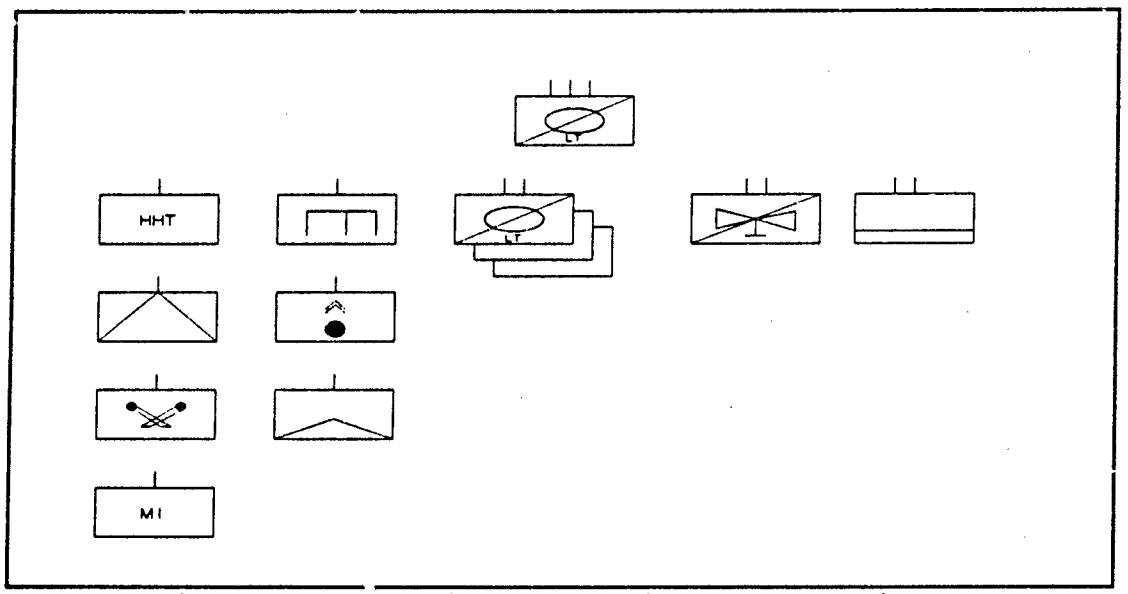


Figure 2-2. Regimental design, alternative 8

c. The first seven alternatives are formed by varying the platform/weapon for three "roles" within the regiment. These three roles are: the close reconnaissance vehicle, the cavalry vehicle, and the light armor vehicle. The first two are in the light cavalry troop and the third is in the light armor troop. All changes occur in the ground cavalry squadron. The individual descriptions follow.

(1) Alternative 1. Each alternative is delineated by equipment types for the close recon vehicle, the cavalry vehicle, and the light armor vehicle. For this alternative, the vehicles are, in order: M113, HMMWV-TOW, and HMMWV-TOW. The close recon vehicles are equipped with a 50/50 mix of MK19 and .50 cal weapons. The HMMWV-TOW for both the cavalry vehicle and the light armor vehicle are equipped with a basic load of six TOW missiles.

(2) Alternative 2. Recon/cavalry/armor: HMMWV/HMMWV-TOW/HMMWV-TOW. This alternative varies from alternative 1 by making the close recon vehicle a HMMWV. Again, it is equipped with a 50/50 mix of MK19 and .50-cal.

(3) Alternative 3. Recon/cavalry/armor: M113/M3/HMMWV-TOW. This alternative uses the M113 for close recon, equipped as in alternative 1. The cavalry vehicle becomes an M3 equipped with 12 TOW missiles. The light armor vehicle stays the same as in alternatives 1 and 2.

(4) Alternative 4. Recon/cavalry/armor: M113/HMMWV-TOW/M3. This alternative swaps the equipment in the cavalry role and the light armor role of alternative 3.

(5) Alternative 5. Recon/cavalry/armor: HMMWV/HMMWV-TOW/M3. This alternative replaces the M113 of alternative 4 with a HMMWV, equipped as in alternative 2.

(6) Alternative 6. Recon/cavalry/armor: M113/M3/M3. This alternative is the heaviest of all the alternatives with tracked vehicles in all roles. These vehicles are equipped as before.

(7) Alternative 7. Recon/cavalry/armor: LAV25/M113-TOW/M113-TOW. This alternative uses the LAV equipped with a 25mm gun for close recon. This is the only alternative which uses something other than a MK19 or .50 cal for the close recon weapon. This alternative is also the only one that uses an M113 equipped with 10 TOW missiles in the cavalry vehicle and light armor venicle roles.

d. Alternative 8 is a modification of the original regimental organization. The deep reconnaissance squadron is eliminated and an additional ground cavalry squadron is added. The equipment is identical to that used in alternative 1. The close recon vehicle is an M113, and both the cavalry vehicle and the light armor vehicle are a HMMWV-TOW. The quantities are increased proportionally for the additional squadron.

e. The alternatives are summarized for quick reference in table 2-2.

Table 2-2. Alternatives summary

Alternative	Close Recon	Cavalry	Lt Armor
1	M113	HMMWV-TOW	HMMWV-TOW
2	HMMWV	HMMWV-TOW	HMMWV-TOW
3	M113	M3	HMMWV-TOW
4	M113	HMMWV-TOW	M3
5	HMMWV	HMMWV-TOW	M3
6	M113	M3	M3
7	LAV25	M113-TOW	M113-TOW
8 *	M113	HMMWV-TOW	HMMWV-TOW

* Alternative 8 uses the same equipment as alternative 1 in a different regimental design.

2-3. Success criteria.

a. The success criteria were designed to reflect the inherent capability of each design to be the "eyes" forward. The capability of each design was measured in terms of the percentage of Red reconnaissance detected and total Red force detected. While these are not pure measurements of a design's inherent capability, the study team thought that these would be indicators of a force's ability to get forward, see forward, and provide information for the development of appropriate intelligence measures. The success criteria were designed to eliminate alternatives not capable of being "eyes" forward.

b. For this analysis, the design of the alternatives, the tactics employed, and the system characteristics prevented the success criteria from being valuable discriminators of mission success. The variations from alternative to alternative were mainly platform changes with some weapon modifications. The variations were so slight that the Blue commander decided the differences did not warrant multiple tactical plans. Based on identical tactical deployment and schemes of maneuver, it became impossible to discern differences among the alternatives in "ability to detect." By mission requirements, each alternative was to strip the threat recon and shadow movement of the main body. All alternatives detected and stripped the entire threat recon. All alternatives similarly shadowed the main body, detecting all front-line forces, with no major differences in performance except for survivability. The difference in survivability was not linked to the positioning, tactics, or movement of the units (they were similar across all alternatives). The difference was related to the survivability of the individual platforms with the HMMWV being the most vulnerable. In conclusion, the success criteria did not eliminate any alternatives.

2-4. EEA. The EEA are listed and answered in appendix B.

2-5. Models.

a. *Janus*. Janus is a high-resolution brigade/battalion level, stochastic model. This model was utilized for the mission analysis which consisted of a SWA screening mission.

b. *Eagle*. Eagle is a low-resolution division-level, deterministic model. This model was used to evaluate the effectiveness of the deep reconnaissance squadron in a SWA scenario.

c. *AALPS*. AALPS is a logistical model which was used to determine aircraft sortie requirements for deployment. This model provided sortie requirements for C-5 and C-141 aircraft.

LIGHT CAVALRY REGIMENT EVALUATION

CHAPTER 3

FINDINGS

3-1. Mission analysis.

a. *Methodology.*

(1) The mission analysis was conducted using the high-resolution, simulation model Janus. The scenario analyzed was a SWA screening mission oriented on a 50km by 50km terrain box of 100 meter resolution. Seven of the eight alternatives were analyzed using this computer simulation.

(2) A subject-matter expert (SME) from CAC-CD FDD reviewed the scenario, conducted his own analysis of the threat presented in the scenario, decided which slice of the regiment was appropriate for this battle, and determined the appropriate tactics for this mission. The original low-resolution scenario required this regiment to screen a frontage of approximately 120km. For this particular snapshot of only 50km frontage, the SME had to choose the appropriate subunits of this regiment that would be committed to this fight while keeping in mind that the remainder of the regiment had to be adequate to conduct an appropriate mission on the remainder of the "ungamed" terrain frontage. The actual maneuver systems and quantities gamed on the Janus terrain box are provided in tables 3-1 and 3-2.

Table 3-1. Equipment for alternatives 1 through 6 in Janus mission analysis

	Close Recon Vehicle		Light Armor/ Overwatch Vehicle		
Alt	M113 (MK19/.50-cal)	HMMWV (MK19/.50-cal)	HMMWV-TOW	M3	OH-58D
1	42	0	36	0	8
2	0	51	36	0	8
3	42	0	12	24	8
4	42	0	24	12	8
5	0	51	24	12	8
6	42	0	0	36	8

Table 3-2. Equipment for alternative 7 in Janus mission analysis

	Close Recon Vehicle	Light Armor/ Cavalry Vehicle	
Alt	LAV25	M113-TOW	OH-58D
7	42	36	8

(3) All other portions of the regiment were the same across all alternatives, therefore, a common slice of all the other elements were allocated to this mission. Because this slice remained constant across the alternatives, any variances which occur should correlate to maneuver systems changes.

(4) The Red force structure remained constant across the alternatives. The systems and quantities are provided in table 3-3.

Table 3-3. Red force structure in Janus mission analysis

Systems	Quantities
T-72	106
BMP	68
Havoc	8
Hind	8
Scorpion	27
Cascavel	36
ZSU	12
SA-8	4
SA-13	8
152 how	144
210 how	36
122 MRL	36
82 mort	15

(5) The results of the battles can be influenced to a great degree by critical data inputs. The most important ones are indicated here. Blue has a decided acquisition advantage, especially in an obscurant environment, because of the lack of forward looking infrared (FLIR) sights on Red combat systems. This advantage is compounded because the majority of the Red force, the tanks, cannot fire their long-range missiles through smoke. The time required to find a defilade position (five minutes) was provided by the Armor School from experience gathered at both the National Training Center and during

Operation Desert Storm. Red systems had the same capability. Although smoke pots and family of scatterable mines (FASCAM) munitions may have been limited in an operational environment, they were unconstrained for this evaluation. All alternatives relied heavily on these assets. Although multiple-launch rocket system (MLRS) were allowed to fire in the antiarmor role, few targets were ever detected that could be effectively engaged. Consequently, this capability was rarely utilized.

(6) In Janus, the selection of and strict adherence to end game criteria are extremely important components of an unbiased and effective analysis. The mission objective of the Red force is to reach the pipeline road, thus preventing the movement of major Blue forces to the east. In the screen, Blue needs only to prevent Red's reconnaissance elements from reaching the pipeline road. The games ended when this was accomplished and when Blue's last maneuver had been completed. An alternative criteria was available, but never met, that would have ended the battle when any Red recon element reached the pipeline road.

b. *Results.*

(1) Force exchange ratio (FER).

(a) The FER ((Red losses/Blue losses)/(Initial Red/ Initial Blue)) for all alternatives is provided in figure 3-1. For the first six alternatives, a consistent pattern of results is apparent. As the number of M3s increases, the force does better. The correlation of the quantity of M3s and the performance of the force relates first to the survivability of the platform and second, to the quantity of missiles on board (12 TOW missiles per M3 versus six TOW missiles per HMMWV). Reconnaissance element equipment of the first six alternatives did not affect force performance. This is linked to the limited capabilities of the MK19 or .50 cal versus the threat systems listed in the Red force structure.

(b) The FER for alternative 7 is slightly higher than the FER for all other alternatives. This result relates to the fact that the LAV25 in the close recon role becomes more than an early warning system. It takes an active role in the fight. The LAV25, with the capability to strip thin-skinned recon vehicles, could actually have played a much larger "killing" role by staying in position longer, but to maintain the ability to discern equipment differences, the tactics were not allowed to vary among alternatives. Therefore, the LAV25 provides early warning as the other recon vehicles did and provides some attrition of the threat recon, but tactics remain constant and the LAV25 turns the fight over to the overwatch vehicles fairly rapidly. It does not kill any "additional" targets in terms of overall kills, but it does take targets away from the air and ground assets. This causes the killing to take place earlier as the LAV25 are positioned slightly farther forward on the battlefield as compared to the cavalry and light armor vehicle.

Because the LAV25 takes targets away from air/ground assets, it also creates a more survivable environment for the M113 as these overwatch vehicles do not have to fight as strenuously with the LAV25 assisting.

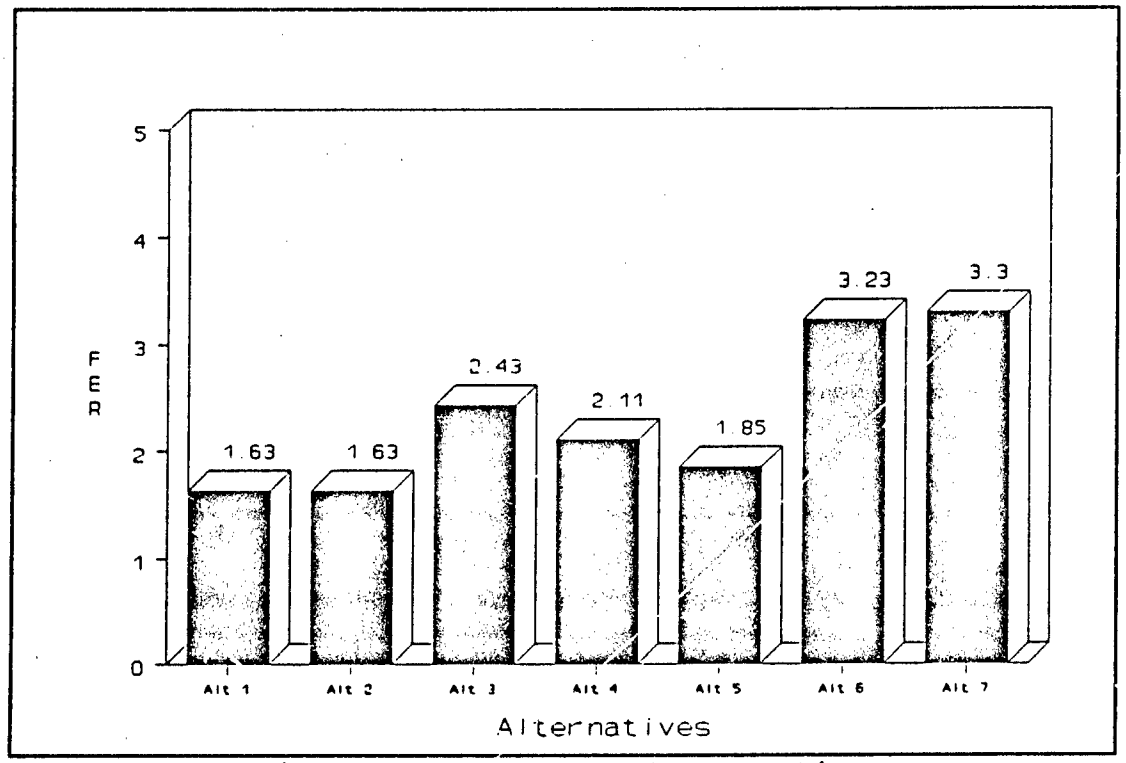


Figure 3-1. Force exchange ratios

(2) Percent contribution.

(a) Percent contribution is provided in figure 3-2. This MOE provides considerable insight into the effectiveness of the different elements of the forces as well as gaming consistency. Clearly, the OH-58D with its three Hellfire missiles was a consistent and major contributor. Regardless of the alternative, approximately one-third of all Red losses were provided by the helicopter force. Likewise, the contributions from mines and artillery, although small, were also consistent.

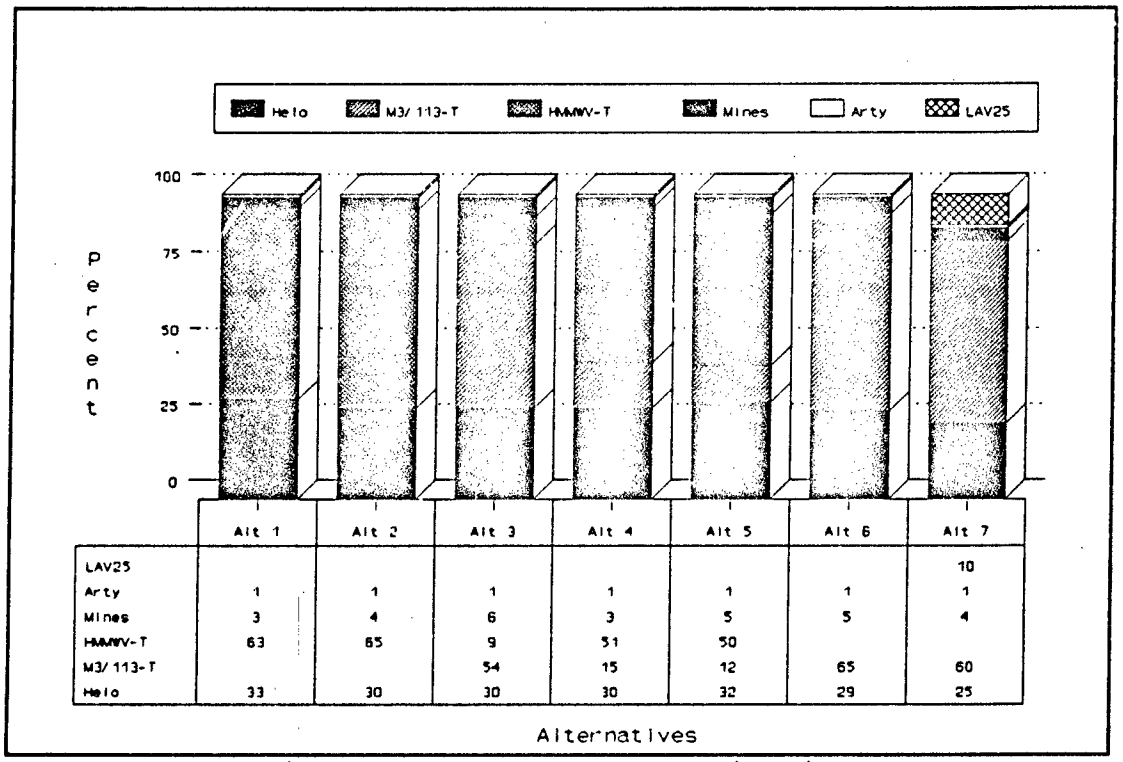


Figure 3-2. Percent contribution

(b) Since the contribution from the cavalry platoons and light armor company in alternatives 1 through 6 account for 63 to 66 percent of all Red losses, it is difficult to differentiate the contribution by specific systems in these organizations. However, some insights can be obtained by comparing specific alternatives. For instance, comparing alternatives 1 and 4 shows that the light armor company in alternative 4 is obtaining 15 percent of the kills when equipped with the M3 with the same cavalry equipment. This graph does not show the breakdown of HMMWV-TOW kills between the cavalry and light armor elements in alternative 1. Closer examination of the postprocessor does provide this breakout. In fact, the HMMWV-TOW equipped light armor company recorded eight percent of the 63 percent kills shown. Obviously, the M3-equipped light armor company is more lethal. It is a direct result of its larger weapons load, better artillery survivability, and longer acquisition capability (higher sight mounting). This result is consistent across alternatives. The M3 is the larger contributor due to lethality and survivability and therefore, results in a higher FER for the alternatives which are M3 equipped.

(c) Alternative 7 has a slightly different system contribution percentage. The LAV25, as the close recon vehicle contributed 10 percent of the total kills. This varies from the

first six alternatives since the close recon vehicle in these alternatives made no contribution to Red kills. The requirement to keep tactics constant across alternatives to measure equipment changes prevented the LAV25 from remaining in position longer and playing a larger role in the attrition battle. The LAV25 did not create "new" kills but instead took targets previously destroyed by the air and ground assets. The contributions of the air and ground assets were reduced by approximately 5 percent each.

(3) System exchange ratio (SER). The SER (Red killed by system x/system x killed) is provided in figure 3-3. The combination of system lethality and system vulnerability is provided in the calculation of the SER. This graph shows those values for all the alternatives. The OH-58D was consistently the best performer. Helicopters killed about 30 percent of the Red force and lost between 1.5 and 2.4 aircraft in the process. The next best performer was the M3. When the M3 was in both the cavalry and light armor elements, the vehicle obtained over nine kills per system lost (alternative 6). The HMMWV-TOW, on the other hand, did only half as well, killing only 4.3 systems per system lost (alternative 2). When the M3 was in the cavalry elements (alternative 3), the system exchange ratio was 10.9, whereas the HMMWV-TOW equipped cavalry element (alternative 2) was 50 percent lower. The LAV25 and the M113-TOW of alternative 7 also had impressive SER. This is attributed to the significant lethality of both systems and their ability to share the fight which increases survivability.

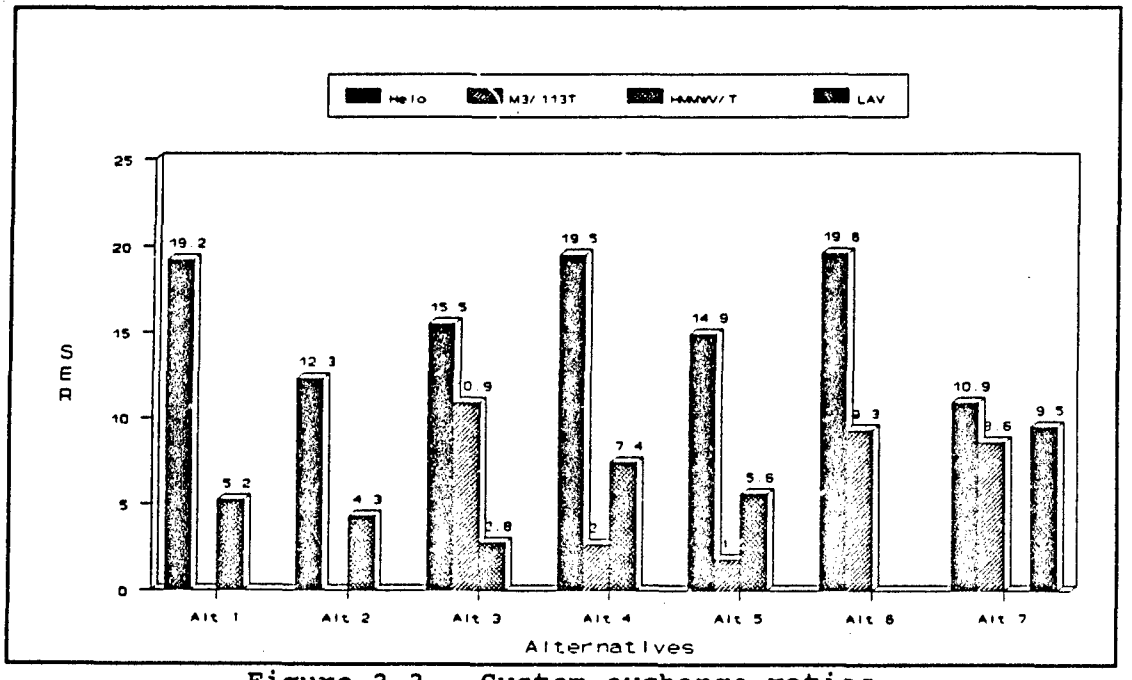


Figure 3-3. System exchange ratios

(4) Losses by specific systems. The losses by specific system are provided in figure 3-4. There are several consistencies in this chart. First, helicopter losses were generally constant across all alternatives varying from a low of 1.5 to a high of 2.4 aircraft averaged over eight replications per alternative. Over 60 percent of these aircraft losses were a result of the air-to-air battle with the remainder a function of random direct fire losses to missile-firing tanks or BMPs. HMMWV-TOWs were much more vulnerable than the M3 when in either the cavalry or light armor elements. Generally, they could be expected to lose anywhere from three to five more vehicles. For instance, comparing alternatives 1 and 6, the HMMWV-TOW equipped force lost five more systems. The difference in the cavalry is shown comparing alternatives 1 and 3 (four systems). With HMMWVs in the recon force, versus M113s, approximately two extra vehicles can be expected to be lost (alternatives 1 vs. 2 and 4 vs. 5). There is one anomaly that stands out. In alternative 5, 7.1 M3s were lost in the light armor company compared to 5.5 in alternative 4 or 4.8 in alternative 3. Review of the battles indicate two stressful games in which the M3s were required to stand longer due to cavalry platoon HMMWV-TOW losses. This was enough to drive the average higher than one would have expected. The bottom line here is that the M3 does survive better than the HMMWV-TOW. The M113-TOW of alternative 7 survived almost as well as the M3 of alternative 6, and the LAV25 survived better than any other close recon vehicle.

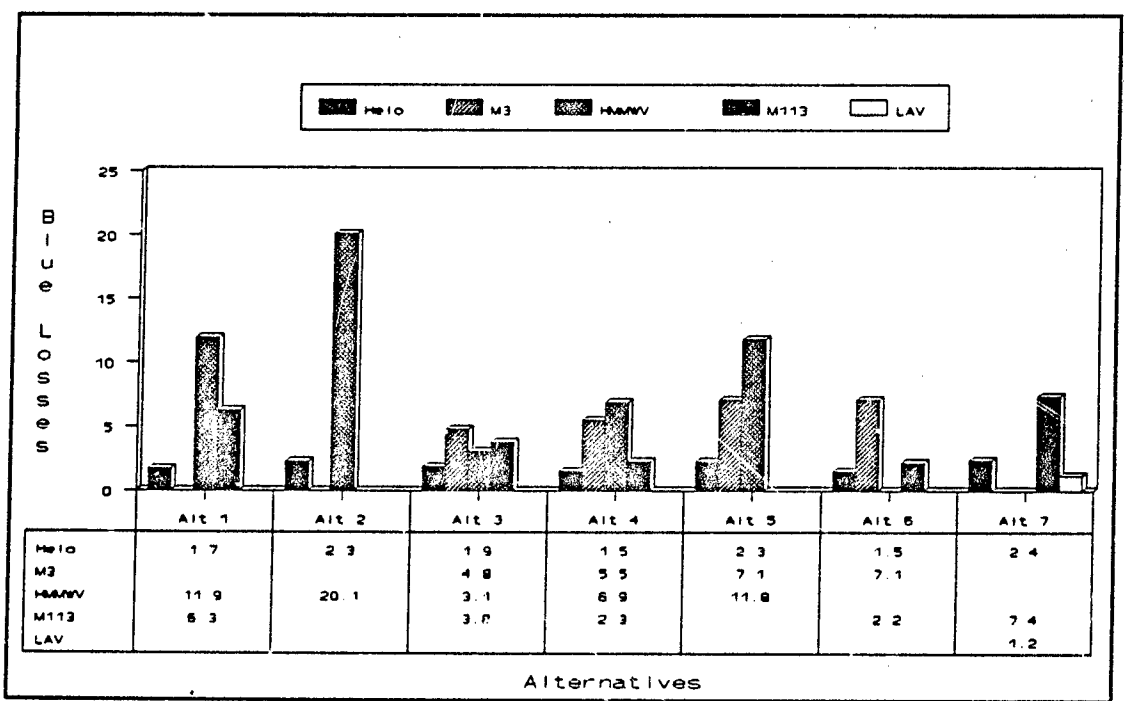


Figure 3-4. Losses by specific systems

3-2. Deep reconnaissance effectiveness.

a. *Methodology.*

(1) The deep reconnaissance mission analysis was done using the low-resolution model Eagle. The scenario was a SWA screening mission with a 100km by 150km terrain box.

(2) An SME from CAC-CD FDD reviewed the scenario and tactics used throughout the simulation. The deep reconnaissance squadron manned three screenlines in depth across a 90km front. Approximately 41 percent of the deep recon squadron was required to man the three screenlines (26 HMMWVs used of 63 available). The remaining HMMWVs were not modeled. Additionally, one field artillery brigade consisting of three MLRS battalions with a total of 81 MLRS launchers provided the indirect fire assets. The MLRS were equipped with ATACMS Blk I and standard MLRS improved conventional munitions (ICM). Blue also had 112 close air support (CAS) sorties flown by the A-10 with four AGM-65 Maverick missiles per aircraft. The deep recon squadron had the mission of attriting the Red forces with CAS and MLRS while delaying the Red advance by 18 hours.

(3) Red force structure and tactics were determined from the SWA 3.0 and 4.0 documents. The Red forces would attack with three divisions to seize an objective approximately 120kms from their initial positions. The systems modeled are shown in table 3-4. No Red artillery forces were represented as their contribution in this scenario would have been limited at best. No Red air was modeled in accordance with guidance from CAC-Threats. Off-line analysis included the Red reconnaissance vehicles totaling 126 Scorpion and 126 Cascavel.

Table 3-4. Red force structure in Eagle

Systems	Quantities
BMP	936
T72	792
BRDM	36
82mm mort	162
120mm mort	18
SA-13	36
SA-18	549

(4) Critical input parameters. The deep recon squadron only engaged the Red forces with indirect fire and CAS. In the simulation, the HMMWVs are undetectable by any Red unit. This was necessary to look beyond survivability issues, as any HMMWV detected by Red was immediately destroyed in the off-line analysis. The HMMWVs had no direct fire capability.

(5) End game criteria. The game was halted when the Red forces reached their objective or were reduced to 65-percent strength.

(6) MOE. Does the deep recon squadron delay the Red force by 18 hours or reduce the Red strength to 65 percent?

b. *Results.*

(1) Unopposed, the Red force was able to traverse the distance to their objective in 6 hours, 48 minutes. Using the deep recon squadron resulted in a reduction of the Red force to 88 percent and an increase in time of 12 minutes to accomplish their mission.

(2) FERs are not applicable as the deep recon squadron was undetectable by Red forces. Off-line analysis indicated that with six hours of time allocated to the Red reconnaissance forces, all HMMWVs would have been acquired and subsequently destroyed. If the LAV25 is substituted for the HMMWV, a larger percentage of the Red reconnaissance is destroyed before the LCS is eliminated.

(3) For analytic purposes, the HMMWVs and LAV25s were considered 100-percent survivable for Eagle to assess the potential of a deep reconnaissance squadron to call fires if the survivability issue could be solved. The results show that the unit can adequately cover the required frontage and can provide information for the placement of deep fires. However, the unit was still found to be ineffective in its synergistic role with deep fires. The limiting factor is the requirement to use only current equipment. Army tactical missile system block I (ATACMS Blk I) does not allow sufficient damage to be done to the threat formations in this scenario. Based on these two factors, vulnerability of the HMMWV and ineffectiveness of Blk I, the effectiveness of the deep reconnaissance squadron was judged as limited.

3-3. Resource support requirement.

a. *Methodology.*

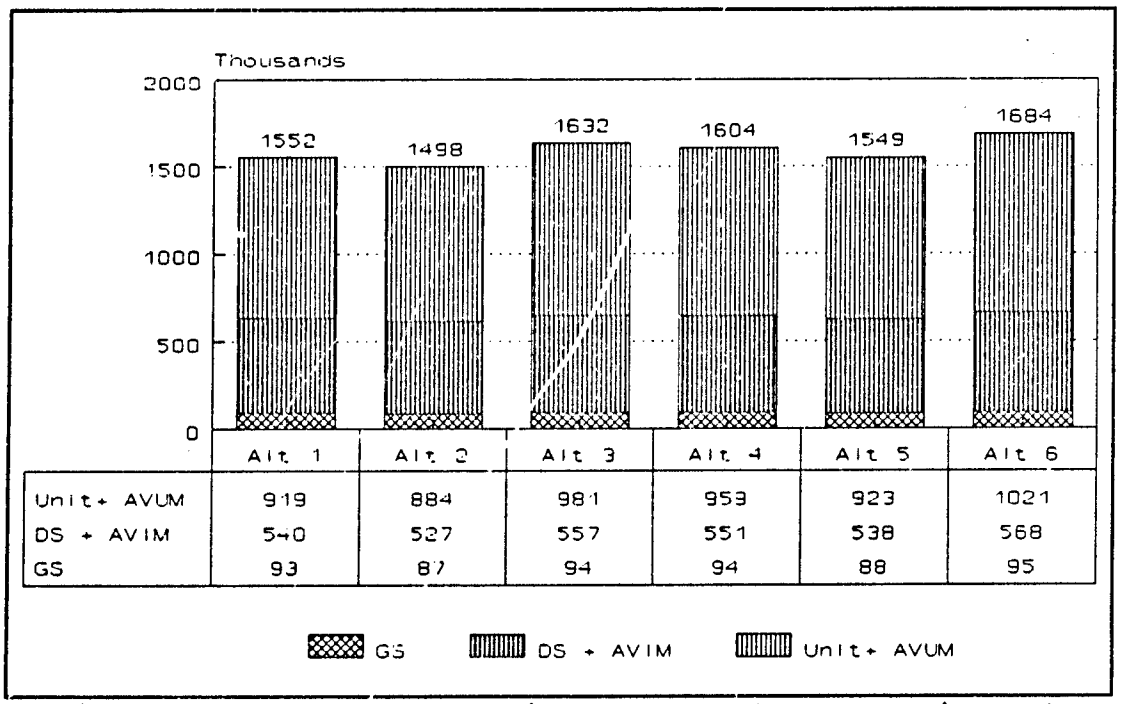
(1) This analysis compared maintenance manpower and supply sustainment across six study alternatives in SWA and North Atlantic Treaty Organization (NATO) scenarios.

(2) The added support requirements of placing the alternative units into a corps force structure were not evaluated due to the similarity of the designs. Internal support requirements were assumed to be adequately addressed in the design of each alternative.

b. *Results.* In many respects, with a few quantitative differences, the requirements to support the various alternative regiments are very similar.

(1) Maintenance.

(a) Figure 3-5 shows the AMMH requirement for each alternative at the unit, DS, and GS levels including the components' aviation intermediate maintenance (AVIM) and aviation unit maintenance (AVUM).



	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
Unit+ AVUM	919	884	981	959	923	1021
DS + AVIM	540	527	557	551	538	568
GS	93	87	94	94	88	95

Figure 3-5. LCR annual maintenance manhours requirement

(b) The maintenance manhours come from the TRADOC AMMH data base for ground systems and from the AR 570-2 maintenance ratios for aircraft.

(c) There is little difference among the alternatives in total manhour requirements. The maximum variation does not exceed 6 percent above or below the average requirement of 1,586K manhours. Alternative 6 has the highest requirement for maintenance due to its higher density of heavy equipment (M113, M3) compared to alternative 2 which has the lowest requirement due to concentration of wheeled (HMMWV) vehicles.

(d) The numbers of mechanics that the GS AMMHs require are shown in figure 3-6. This figure shows the GS mechanic requirements among the six alternatives.

(e) The GS requirement is a true external support requirement since all GS maintenance is handled externally as opposed to unit and AVUM maintenance which is all internal.

(f) There is little difference among the alternatives in the requirements for missile maintenance (MOS 27) and automotive maintenance (MOS 63). The variation is caused by the combination of vehicles (wheeled and tracked) with tracked vehicles being the primary driver.

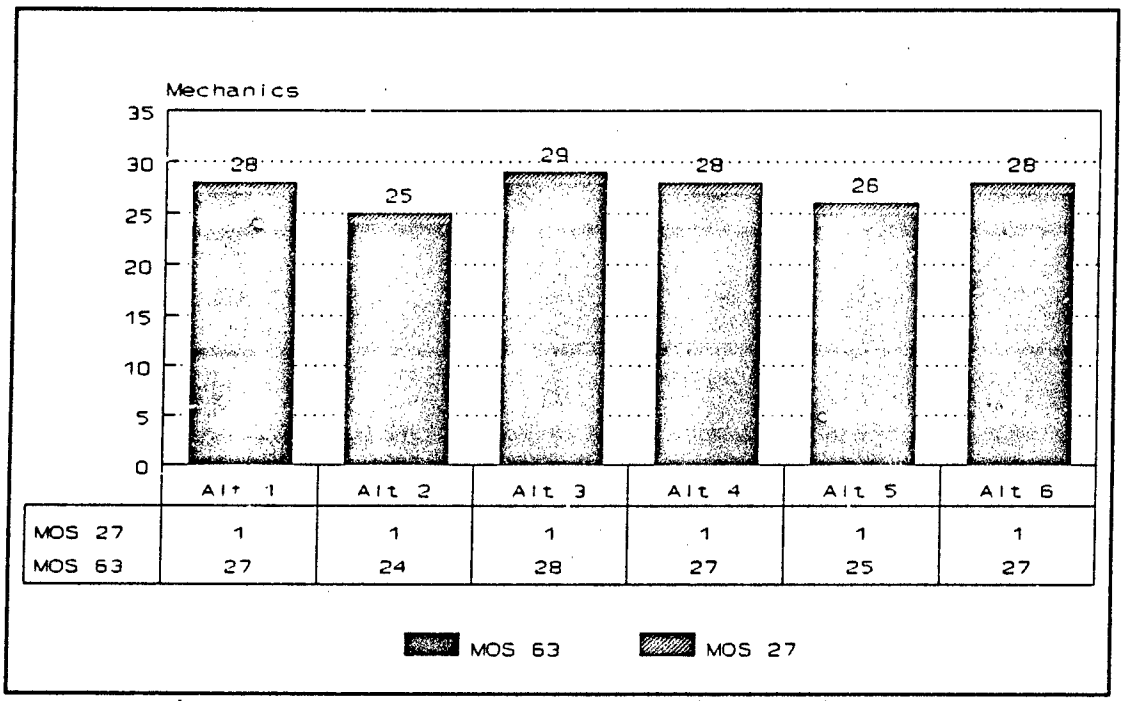


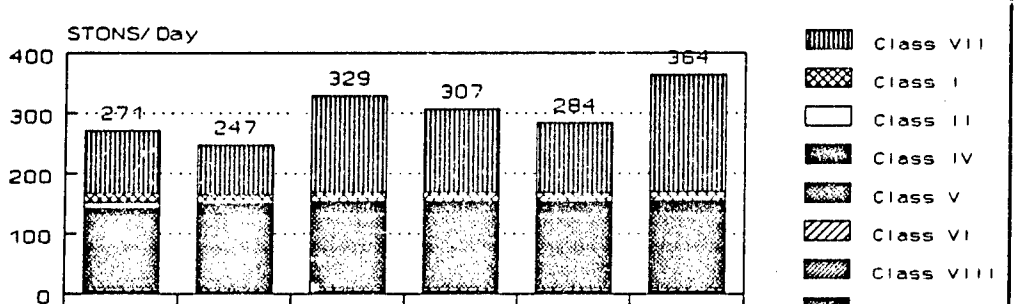
Figure 3-6. LCR LIA GS mechanic requirements

(2) Supply sustainment. A description of the classes of supply is shown in table 3-5 for reference. The rates for each class were provided by the Combined Arms Support Command (CASCOM) in accordance with the provisions of AR 700-8 for Army logistics planning factors management and are the same rates used in the TAA-99.

Table 3-5. Classes of supply

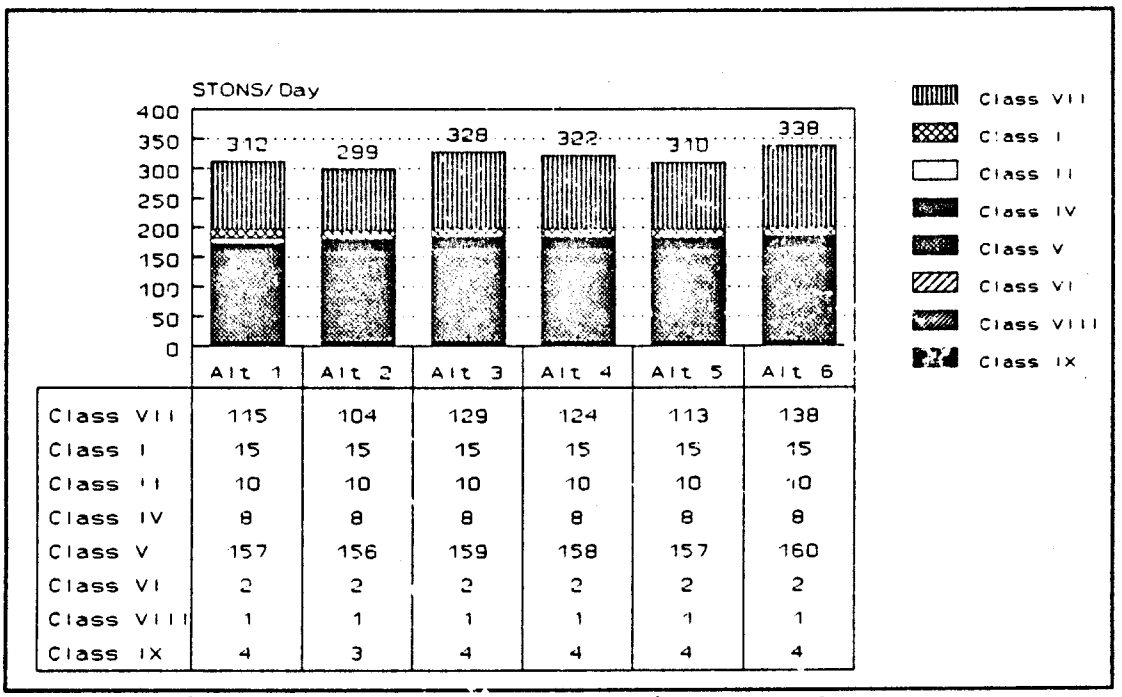
Class I	-	Subsistence
Class II	-	Clothing, tools, individual equipment, administrative, and housekeeping supplies
Class III	-	Petroleum fuels, oils, and lubricants
Class IV	-	Construction and barrier materials
Class V	-	Ammunition
Class VI	-	Personal demand items
Class VII	-	Major end items
Class VIII	-	Medical supplies
Class IX	-	Repair parts

(a) For dry commodities expressed in short tons (STONS), the ranking of requirements from lowest to highest is shown in figure 3-7 for SWA and in figure 3-8 for NATO. There are differences in classes V, VI, and VII. Class V SWA are all smaller since they are defined as 80 percent of NATO. Class VI SWA is double the NATO rate as expected for an undeveloped theater. Class VII varies depending on vehicle type. Tracked vehicles have a higher loss rate in SWA than in NATO due to the threat, scenario, and environmental factors played for the SWA rates.



	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
Class VII	104	82	160	138	116	194
Class I	15	15	15	15	15	15
Class II	10	10	10	10	10	10
Class IV	8	8	8	8	8	8
Class V	125	124	127	127	126	128
Class VI	4	4	4	4	4	4
Class VIII	1	1	1	1	1	1
Class IX	4	3	4	4	4	4

Figure 3-7. Short ton requirements for SWA



	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
Class VII	115	104	129	124	113	138
Class I	15	15	15	15	15	15
Class II	10	10	10	10	10	10
Class IV	8	8	8	8	8	8
Class V	157	156	159	158	157	160
Class VI	2	2	2	2	2	2
Class VIII	1	1	1	1	1	1
Class IX	4	3	4	4	4	4

Figure 3-8. Short ton requirements for NATO

(b) Bulk fuel requirements (CL III) as shown in figure 3-9 correlate closely (along with maintenance and class VII) with fleet weight. Track requirements are higher than wheel requirements. Aircraft have no impact on this analysis because all alternatives have the same density of aircraft.

(c) Water consumption is shown in figure 3-9. Water consumption for this analysis was based on 20 gallons per person per day and is therefore strictly population driven. All theaters have a requirement to produce water, but only SWA has a requirement to produce AND distribute water.

(d) Alternative 6 has the highest requirements and alternative 2 has the lowest. SWA requirements are higher than in NATO, but the relationship among the alternatives remains the same.

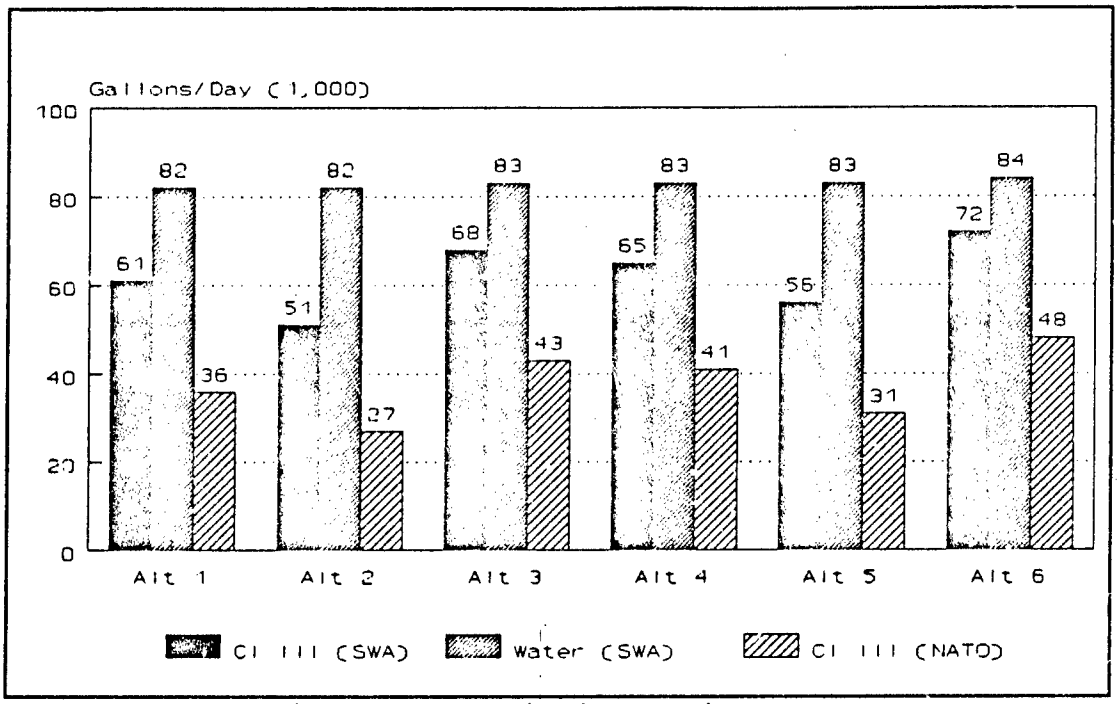


Figure 3-9. Liquid requirements

3-4. Deployment.

a. *Methodology*. This analysis examined the air deployment of eight force designs as outlined. Force deployment for this analysis was to a SWA area of operations. The analysis used airlift sortie requirements that would be needed to deploy each of the forces using C-5 and C-141 Air Force cargo aircraft from the Military Airlift Command (MAC).

b. *Results*. The required sorties are presented in figure 3-10. Sorties correlate to the weight of the alternative. The weight of the alternative is driven by the quantity of tracked vehicles. Alternative 8 is the heaviest due to the fact that it includes three ground cavalry squadrons.

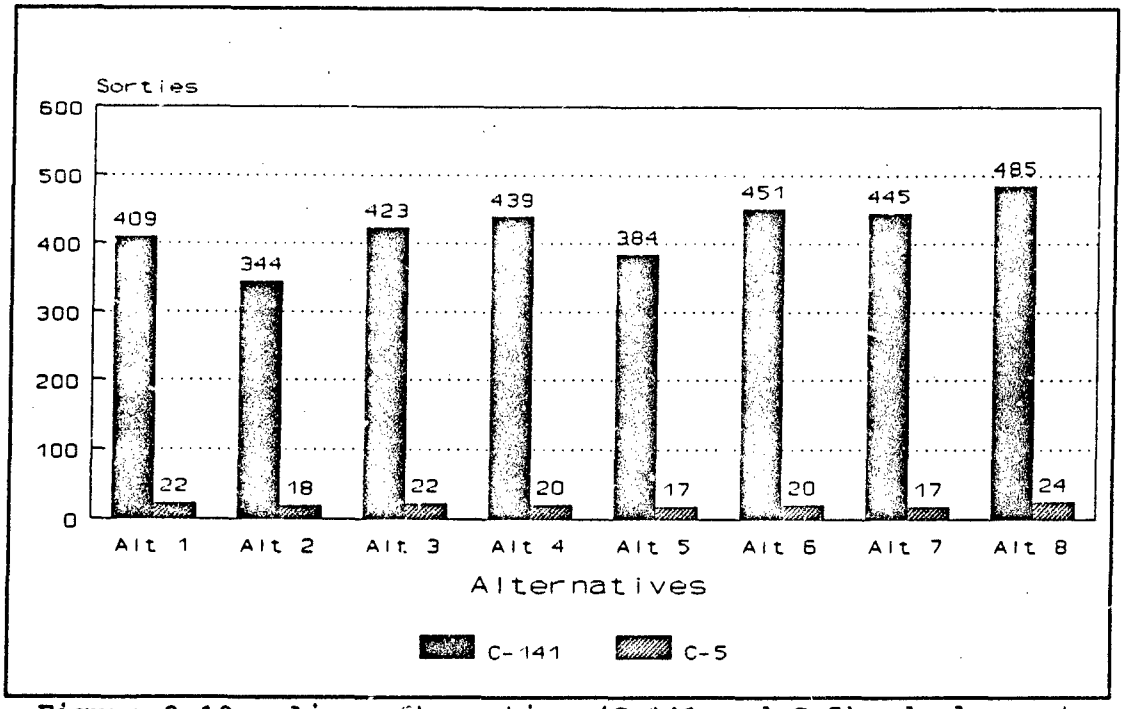


Figure 3-10. Aircraft sorties (C-141 and C-5), deployment

LIGHT CAVALRY REGIMENT EVALUATION

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

4-1. Conclusions.

a. LIA. The comparison among the alternatives shows very little difference in the area of logistics. Similarity in organizational structure and personnel requirements drove most of the logistic requirements to be similar. Differences correlated to the quantity of tracked vehicles versus wheeled vehicles.

b. Deployment. Although the number of sorties required for deployment of each alternative reflect a difference, without a predetermined standard or requirement there is no way to truly determine a level of sortie requirement that is either unacceptable or favorable. Without this information, which the study sponsor is not able to state categorically, this area is merely presented for relative comparison.

c. Mission analysis.

(1) The mission analysis did discern some differences which are valuable. Among the first six alternatives, it becomes obvious that the comparison of the M3 versus the HMMWV, in the roles of cavalry vehicle or light armor vehicle, favors the M3. Again, this is directly correlated to the larger weapons load, better survivability against artillery attack, and longer-range acquisition capability of the M3. The comparison among the first six alternatives of the close recon vehicle shows no real difference between the M113 and the HMMWV. This result is directly correlated to the similar weapon capability of MK19/.50-cal which is associated with both chassis. In the mission analyzed, these close recon vehicles were of very little use. They were merely targets.

(2) Alternative 7 demonstrates results somewhat different from the first six alternatives. In alternative 7, the LAV25 served as the close recon vehicle capable of taking an active role in the fight. This vehicle was able to detect as early as the close recon vehicles of the first six alternatives but, in addition, it was able to attrit approximately 11 percent of the force. This active role of the LAV25 certainly provides insight into equipping the close recon vehicle with a weapon system with contributing range and firepower. In becoming an active participant in the fight, the LAV25 took targets away from the air and ground assets. This allowed the other ground systems to survive better based on a decreased mission requirement. There is a slight decrease in OH-58D survivability which is attributed to the fact that the LAV25 was stripping away the forward, thin skinned recon vehicles which had previously belonged to the air assets. Now the OH-58Ds stayed in position longer waiting for

the LAV25 to turn over the battle and faced more capable threat systems. The decrease in survivability is marginal.

d. Recon squadron effectiveness. The Eagle analysis proved the ineffectiveness of the deep reconnaissance squadron built with current equipment. Off-line analysis proved the HMMWV/LAV25 based recon squadron to be of questionable survivability. The requirement for sufficient density, in order to adequately cover the terrain and the silhouette of the HMMWV/LAV25, proved it to be an inappropriate deep recon vehicle for this mission and this terrain. Accepting the probable limited survivability of the HMMWV/LAV25, while allowing it to be completely survivable for analytic purposes, still proved this unit to be ineffective in its mission. The ability of this unit to call destructive fires is a function of its inherent capability in union with the capability of the deep fires. Restricted to current systems which would only include ATACMS Blk I, this unit proved ineffective in destroying significant numbers of threat vehicles with the lethality of ATACMS Blk I.

4-2. Recommendations.

a. The conclusions of the mission analysis support the inclusion of a close recon vehicle equipped with a weapon of contributing range and an M3 in the role of cavalry and light armor vehicle. This is strictly from a mission analysis point of view and does not consider the other areas of analysis.

b. The deployability analysis offers insight into an area which may become extremely prohibitive. The availability of aircraft may be deemed a factor equal in weight to the mission analysis during times of high demand on resources. In this case, the performance increase of the M3 over the M113-TOW and the HMMWV-TOW may not warrant the additional sorties required to air deploy the M3. The M3 requires at least one C-141 to air deploy. Deployment configurations used by current units call for six C-141s for every four M3s. This demand on available aircraft makes the M3 alternatives less desirable. As the deployment analysis was ongoing, the certification for the M3 to be air deployed on a C-141 was pulled because of substantiated damage to both the aircraft and the M3 during the loading process. With this information, a more appropriate overwatch vehicle and light armor vehicle may be the more readily deployable M113 or the HMMWV which offer only slightly reduced capabilities in comparison with the M3.

c. The Eagle analysis substantiates the elimination of the deep reconnaissance squadron from the regiment. The highly vulnerable HMMWV/LAV25 and the marginally effective deep fires do not warrant the inclusion of this unit. No analysis was done to determine an appropriate replacement. Since the ground cavalry squadron and the regimental aviation squadron both contribute significantly in terms of mission capability, perhaps the spaces could be better utilized by inclusion of an additional squadron of either of these assets.

APPENDIX A

STUDY TASKER

ATZL-CDF-A 5 November 1991

MEMORANDUM FOR DIR, TRAC-OPERATIONS ANALYSIS CENTER

SUBJECT: Analytical Support for Light Cavalry Regiment Study

1. Reference. Meeting of 1 Nov 91 attended by MAJ Murdock and Mr. Torok, FDD, CAC-CD, and LTC Spencer, MAJ Matson and Mrs. Prueitt, TRAC-OAC.

2. The referenced meeting was held to discuss possible TRAC support for the continuing Light Cavalry study. Based upon this discussion, request you provide the following analytic support:

a. Using designs for the ground cavalry squadrons provided by FDD, evaluate lethality, deployability, and survivability of each alternative. FDD can provide a notional sortie rate and TPFD if they are deemed essential to the evaluation.

b. Conduct a logistics analysis which provides, as a minimum, insights into Class III, V, VII, and IX requirements of the alternatives.

c. Assess the effectiveness of the Reconnaissance Squadron with current equipment.

3. For analytical purposes, the following guidance applies:

a. Use personnel, equipment and sortie rates developed for the AGMC support squadron as a constant throughout this analysis.

b. Scenario priority should be Southwest Asia (SWA), Latin America (LATAM), and Europe (EUR), in order.

4. Initial results should be available to this organization by 15 Jan 92.

5. POC for this action is MAJ Murdock or Mr. Torok, 4580/4882.

R.L. Keller

ROBERT L. KELLER
GM15
Director, FDD

APPENDIX B

ESSENTIAL ELEMENTS OF ANALYSIS

APPENDIX B
ESSENTIAL ELEMENTS OF ANALYSIS

B-1. Missions.

a. *How well is the unit able to detect all enemy forces in its area of interest? (EEA 1)*

(1) The first seven alternatives were gamed in the high-resolution SWA screening mission. The first six alternatives were so similar in design, tactics, capabilities, and outcome that they will be discussed together. Alternative 7 varied in capability and outcome from the first six and will be addressed separately.

(2) The common regimental structure and similar vehicular missions (close recon, cavalry, and light armor) across the first six alternatives caused the Blue commander to tactically deploy and fight them in the same fashion. This decision was based upon these facts:

(a) The close recon vehicle, regardless of whether it was a HMMWV or an M113, was equipped with the same acquisition capability and weapon system. The weapon system was a 50/50 mix of MK19 and .50-cal. Similar acquisition and lethality capability caused these systems to be tactically deployed in the same positions on the terrain. The vulnerability of these vehicles and the limits of the weapon systems forced the commander to withdraw these vehicles early producing similar fighting capability of the close recon vehicles across the alternatives. Mobility differences were not discernable on the terrain used in this scenario. The majority of movement was conducted on roads. The survivability of the two platforms became the only discernable difference.

(b) The cavalry vehicle and light armor vehicle, regardless of whether it was a HMMWV or an M3, utilized the TOW missile for its primary weapon. The similarities in capabilities of these systems (i.e., missile range) caused the tactical deployment for these vehicles to be identical across the six alternatives. The resulting destruction capability of these vehicles correlate both to the capability of the missile and the survivability of the platform. Since the missile was the same across the alternatives (except for quantities), survivability again became a major discriminating factor.

(c) The air assets were identical across all alternatives. Each of these alternatives included one regimental aviation squadron. For this SWA screening mission, one troop of eight OH-58D was allocated. Therefore, the air contribution was the same across all alternatives.

(3) Alternative 7 shared a common regimental structure with the first six alternatives. This alternative differed by using the LAV25 for close recon and the M113-TOW for cavalry and light armor. The major difference in alternative 7 is the capability of the LAV25. Using this vehicle for close recon adds firepower capability which was missing in the first six alternatives. No tactical deployment or scheme of maneuver changes were made for this new capability. The main difference noted in outcome was that the LAV25 was a contributor in the killing battle where previously the close recon vehicle's role was limited to early warning because of the MK19/.50-cal capability.

(4) The MOE used for this EEA was the number of Red systems detected. With the capabilities, tactical deployment, and schemes of maneuver being similar across all alternatives, the number of Red systems detected was equal for all alternatives. It was not possible to discern differences among the alternatives related to their inherent capability to "detect."

b. *How well is the unit able to perform surveillance without being detected? (EEA 2)* Refer to EEA 1 for details of the similarities of how each of the alternatives were tactically deployed and fought. The MOE for this EEA was the number of Blue elements detected. Based on the information from EEA 1, similar positioning on the terrain and similar schemes of maneuver, no differences were found among the alternatives in ability to perform surveillance without being detected. All alternatives had a similar number of Blue elements detected and no advantages existed where the systems of one alternative were noticeably less "detectable."

c. *How well is the unit able to repel and/or destroy enemy reconnaissance elements? (EEA 3)*

(1) All alternatives were successful at destroying the entire enemy reconnaissance (91 vehicles). The manner in which this was accomplished was similar across the first six alternatives. In these alternatives, approximately 30 percent of the kills were attributed to the air assets (eight OH-58Ds), 60 percent of the kills were attributed to the overwatch vehicle, and the remaining kills were spread across the other Blue assets (light armor vehicle, artillery, and mines).

(2) Alternative 7 was also successful at destroying the entire threat recon. This alternative varied by system contribution. The close recon vehicle in this design was a LAV25. The 25mm gun provided capability beyond that of the MK19 and .50-cal of the other designs. The LAV25 became an active portion of the killing battle. It was responsible for 11 percent of the kills. These were not "additional" kills but kills that would have belonged to the air or overwatch assets in the other designs.

d. *How well is the unit able to bring fires onto observed enemy forces? (EEA 4)* The size of the Janus screen was 50km by 50km. With the screen line stretching diagonally across the terrain there were limited range opportunities to employ artillery. Most targets were within danger close range when observed. Janus realistically portrays the ineffectiveness of artillery against moving, armored columns, as seen in this scenario. These facts in combination with the similar tactical deployment and schemes of maneuver made this EEA impossible to differentiate among the alternatives. The number of Red systems killed by Blue artillery across all alternatives was consistently one percent of all Red killed.

e. *How well is the unit able to survive while performing its mission? (EEA 5)*

(1) As explained in EEA 1, these alternatives offered more similarities than differences. The weapon systems, the tactical deployment, and the schemes of maneuver were basically identical across the first six alternatives. The major difference occurred in the survivability of the design, and this was directly correlated to the survivability of the platforms. Alternative 2 suffered the greatest amount of Blue losses. This alternative contained the largest number of HMMWV chassis. Alternative 6 suffered the least amount of Blue losses. This alternative contained no HMMWV chassis and included a preponderance of M3. The other alternatives of the first six fall in rank based on the quantity of HMMWVs. This conclusion is obvious because, as explained in EEA 1, the tactics or schemes of maneuver which could have varied to offer different levels of protection did not vary and, therefore, the platform survivability equals the survivability of the design.

(2) Alternative 7 shows survivability similar to alternative 6, and this is not directly correlated to the survivability of the platforms. In alternative 7, survivability is enhanced by the active role the LAV25 plays in assisting in the battle. By becoming an active agent, the LAV25 improves the survivability of the M113-TOW by reducing its mission requirements.

B-2. Deployment.

a. *How well can each of the alternatives be deployed by air? (EEA 6)* The number of C-141 and C-5 sorties required for each alternative to air deploy are provided in figure B-1.

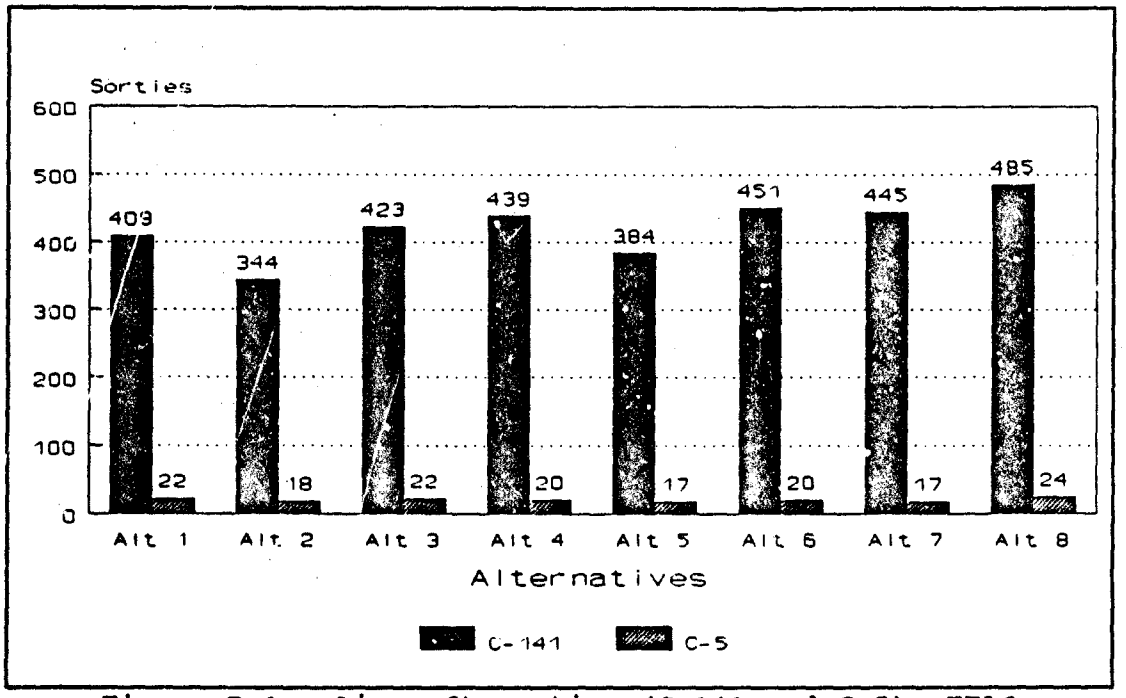


Figure B-1. Aircraft sorties (C-141 and C-5), EEA6

b. *How well can each of the alternatives be resupplied by air with classes III and V? (EEA 7)* Supplies consisted of dry cargo (to include packaged petroleum items) and ammunition. Bulk fuel and water will normally be supplied by host nation support or purchased through contracting agents. Overall sustainment of the forces had no real impact on the deployment of any of the force designs. The alternative can be resupplied equally well.

B-3. Logistics impact analysis.

a. *What are the logistics force structure requirements at corps for each of the alternatives? (EEA 8)* Only the first six alternatives were analyzed for logistics implications. Among these six alternatives the differences in the alternatives were so slight that the logistics force structure analysis was deemed nondiscriminating.

b. *What are the (AMMH) requirements for each of the alternatives? (EEA 9)* The AMMH for each alternative are provided in figure B-2. There is little difference among the alternatives in total manhour requirements. The maximum variation does not exceed 6 percent above or below the average requirement of 1,586 thousand manhours. Alternative 6 has the highest requirement for maintenance due to its higher density of heavy equipment (M113, M3) compared to alternative 2 which has the lowest requirement due to its concentration of wheeled (HMMWV) vehicles.

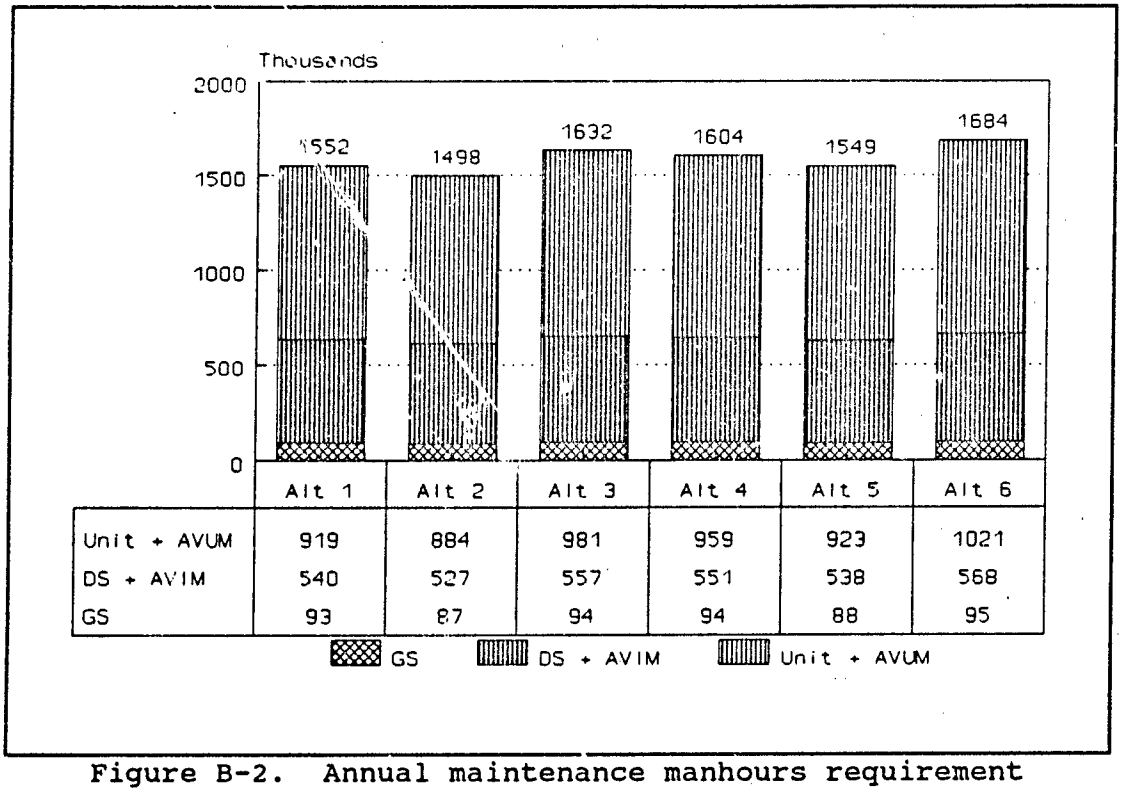


Figure B-2. Annual maintenance manhours requirement

c. *What are the mechanic manpower requirements by MOS at the GS level created by the AMMH requirements above? (EEA 10)*

(1) The number of mechanics required for the GS AMMHs are shown in figure B-3. The GS requirement is a true external support requirement since all GS maintenance is handled externally as opposed to unit and AVUM maintenance which is all internal.

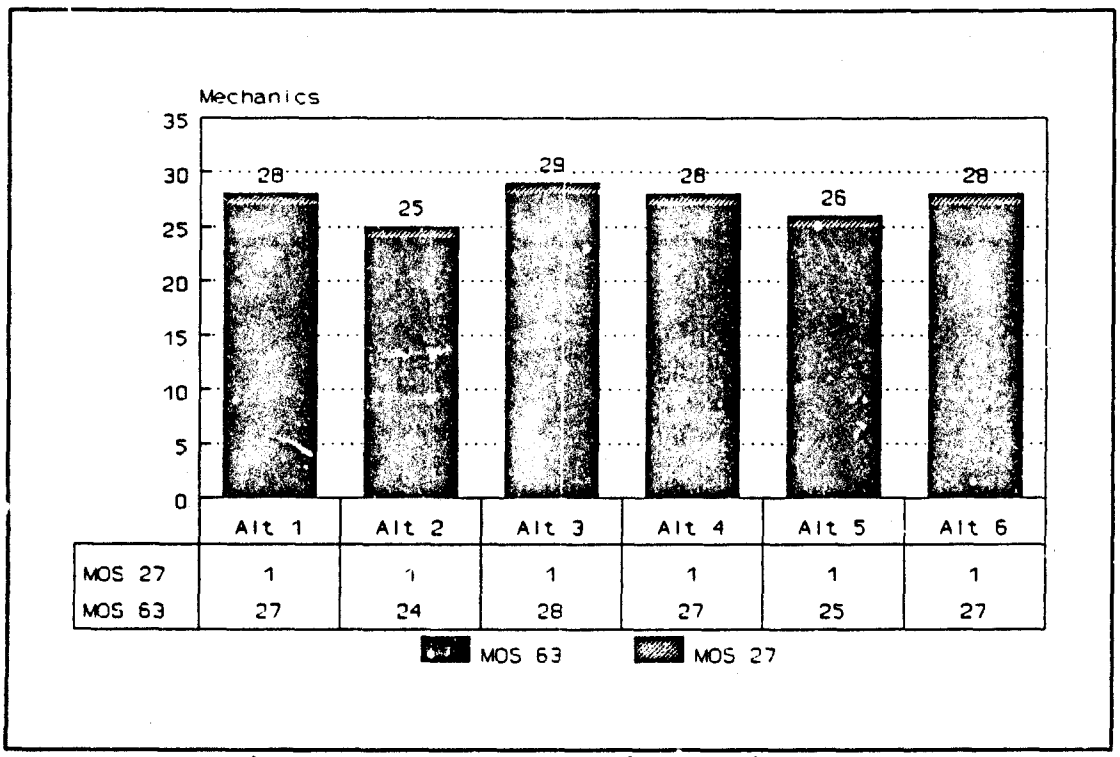
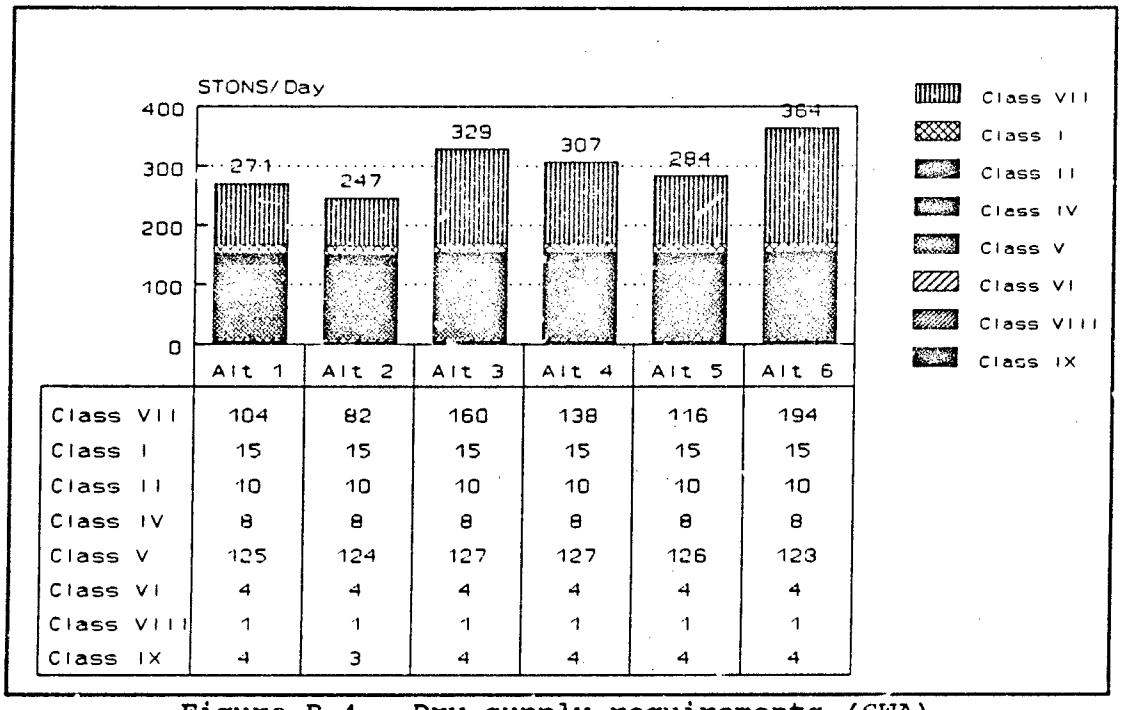


Figure B-3. GS mechanic requirements

(2) There is little difference among the alternatives in the requirements for missile maintenance (MOS 27) and automotive maintenance (MOS 63). The small variation is caused by the combination of vehicles (wheeled and tracked) with tracked vehicles being the primary driver.

d. *What are the supply requirements for each of the alternatives at the regiment level in each theater? (EEA 11)* The supply requirements for each of the alternatives were calculated in two different theaters of operations. Supply factors for SWA and NATO produce the supply requirements by class as shown in figures B-4, B-5, and B-6.



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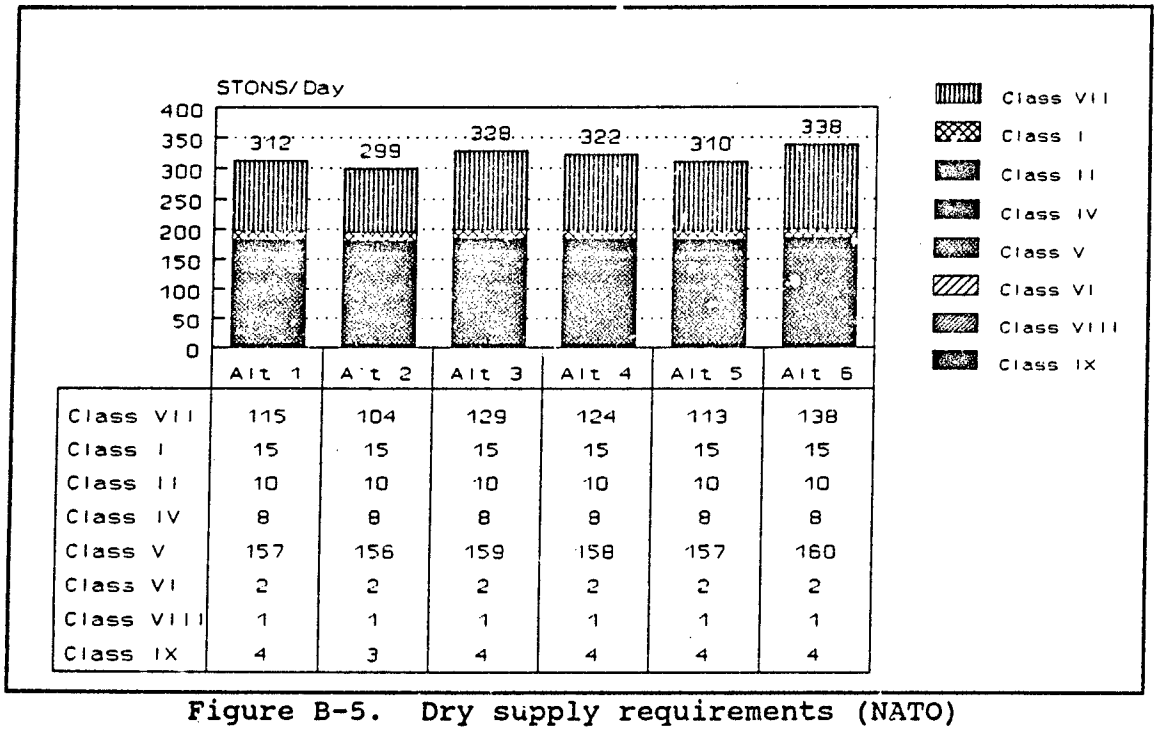
Class V	125	124	127	127	126	123
Class VI	4	4	4	4	4	4
Class VIII	1	1	1	1	1	1
Class IX	4	3	4	4	4	4

Figure B-4. Dry supply requirements (SWA)



	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
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Class VIII	1	1	1	1	1	1
Class IX	4	3	4	4	4	4

Figure B-5. Dry supply requirements (NATO)

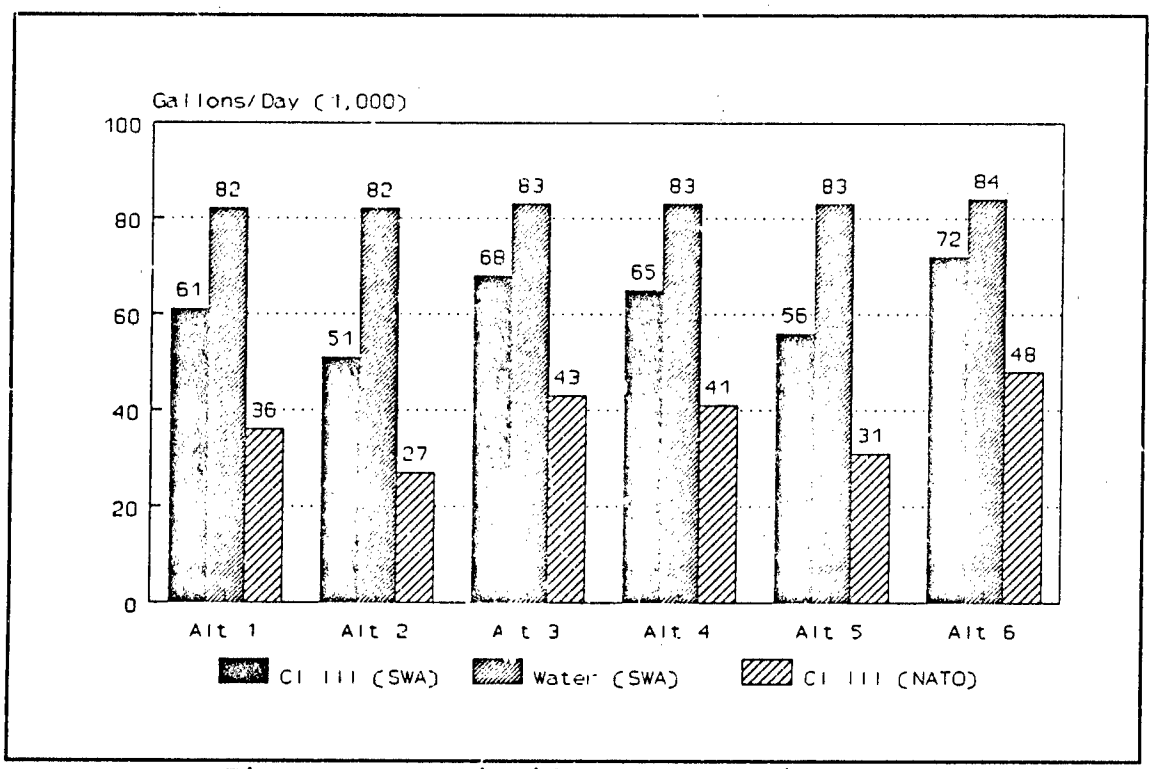

Figure B-6. Liquid supply requirements

e. *What are the requirements for major items of equipment to support the supply requirements determined above? (EEA 12)* The CSS structure, common to all alternatives, was judged adequate to support supply requirements.

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